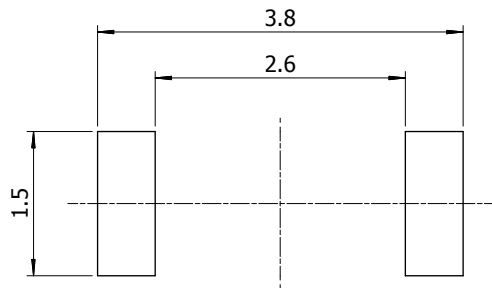
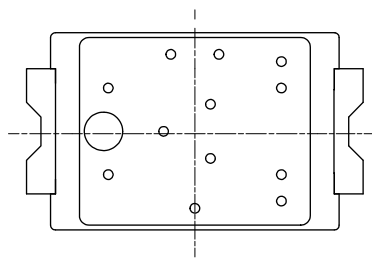
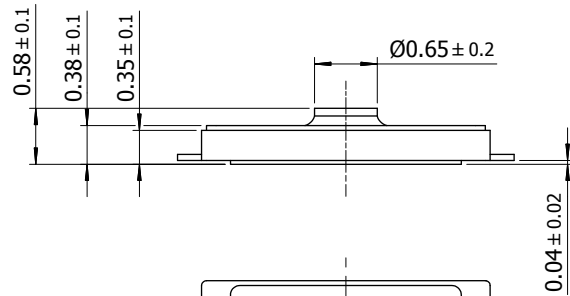
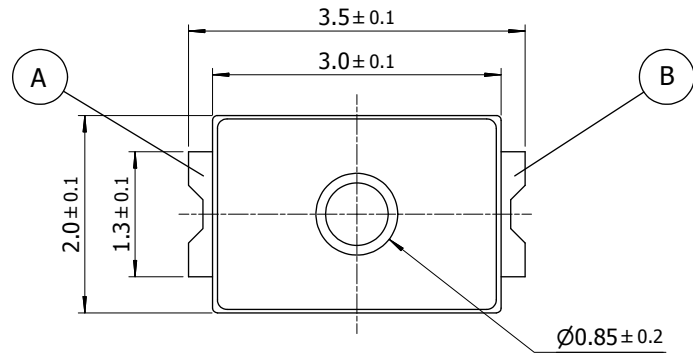
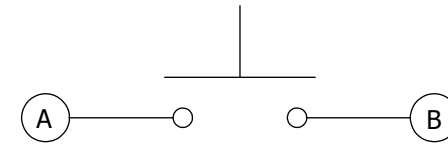


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|--------|---------------|------------|-----------|
| RevNO. | Revision note | Date | Signature |
| 1 | 도면 Redrawing | 2014.07.28 | |
| | | | |



PCB SOLDER LAND DIMENSIONS



CIRCUIT DIAGRAM

NOTE

1. RATING : DC 12V 50mA
2. CONTACT RESISTANCE : 500mΩ max.
3. TRAVEL : 0.13±0.05mm
4. GENERAL TOLERANCE : ±0.3
5. MANUFACTURING SPECIFICATION WOULD BE ACCORDANCE WITH JT 0165

| | | | | | |
|------------|--------------|----------|-------------|------------|---------|
| JTP-1158P | | 180±50gf | 300,000 | BLACK | |
| JTP-1158 | 110011158114 | 180±50gf | 300,000 | BLACK | |
| Model name | Code no | O/Force | Life cycles | Case color | Remarks |

| | | | | |
|----------------------|----------------------------|---------|------------|-----------------|
| Designed by B.SAGONG | | | | |
| Checked by | | Unit mm | Scale 18/1 | Date 2013.05.06 |
| Approved by T.H.OH | Item TACTILE S/W | Tool In | Sheet 1 | Rev. 1 |
| Model JTP-1158 | Drawing name ASS'Y DIAGRAM | | | |

| | | |
|--|---------------|-------|
| | SPECIFICATION | PAGE |
| | TACT SWITCH | 1 / 5 |

1. GENERAL

1.1 Application : This specification is applied to low current circuit tactile switch for electronic equipment.

1.2 Operating temperature range : -30~ 85°C (Normal humidity, Normal air pressure)

1.3 Storage temperature range : -40 ~ 90°C (Normal humidity, Normal air pressure)

1.4 Test conditions : The standard test conditions shall be 5 ~ 35°C in temperature, 25 ~ 85% RH and 860 ~ 1060mbar in atmospheric pressure. Should any doubt arise in judgement, tests shall be conducted at 20±2°C, 65±5% RH and 860 ~ 1060mbar.

2. RATED VOLTAGE AND CURRENT.

DC 12V 50mA

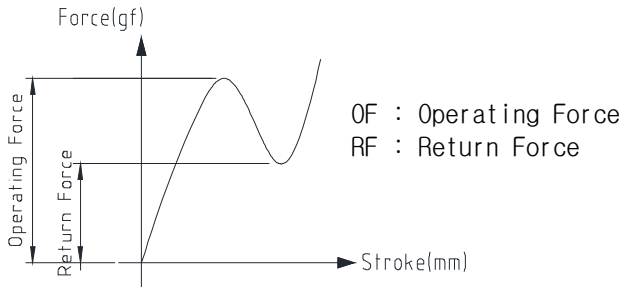
3. ELECTRICAL PERFORMANCE

| | PROPERTY | TEST CONDITIONS | PERFORMANCE |
|-----|-----------------------|--|---|
| 3.1 | Contact arrangement | | * 1 pole, 1 throw. |
| 3.2 | Contact resistance | Measured at DC 5V 10mA or by ohmmeter allowing a small current at 1kHz with 150% of Actuating force. | * 500mΩ Max. |
| 3.3 | Insulation resistance | DC 100V is applied between terminals and between terminals and earth for 1minute ±5seconds. | * 100MΩ Min. |
| 3.4 | Dielectric strength | AC 100V (50 ~ 60Hz)is applied between terminals and between terminals and earth for 1 minute. | * No insulation defect shall be observed. |
| 3.5 | Bounce | Measured by lightly striking the center of the button stem at a rate of 3 operations/sec. | * 10 msec Max. |

| | | | | | | | | | | |
|------|------|------|------|------|------|------|------|------|--------------|-----------------|
| | | | | | | APPD | CHKD | DSGN | TITLE | JTP 1158 SERIES |
| | | | | | | | | | DOCUMENT NO. | JT 0165 |
| ZONE | SYMB | DATE | APPD | CHKD | DSGD | | | | | |

| | | |
|--|---------------|-------|
| | SPECIFICATION | PAGE |
| | TACT SWITCH | 2 / 5 |

4. MECHANICAL PERFORMANCE

| | PROPERTY | TEST CONDITIONS | PERFORMANCE |
|-----|-----------------|---|---|
| 4.1 | Operating force | A gradually increasing load is applied to the center of the button stem. | * As per individual manufactured drawing. |
| 4.2 | Return force | After actuating, the load is gradually decreased until the stem returns to its free position. | *100gf : 20gf Min. *180gf, 240gf : 40gf Min. |
| 4.3 | Click ratio | Click ratio : $(OF - RF) / OF \times 100$  OF : Operating Force RF : Return Force | *There shall be provided only initial value. 40% Min. |
| 4.4 | Stop strength | A static force of 3Kgf shall be applied to the direction of operation for 15 seconds. | * Shall be free from mechanical and electrical abnormalities. |
| 4.5 | Travel | | * 0.13 ± 0.05 mm |
| 4.6 | Arrangement | | * Tactile feed-back. |

| | | | | | | | | | | |
|------|------|------|------|------|------|------|------|------|--------------|-----------------|
| | | | | | | APPD | CHKD | DSGN | TITLE | JTP 1158 SERIES |
| | | | | | | | | | DOCUMENT NO. | JT 0165 |
| ZONE | SYMB | DATE | APPD | CHKD | DSGD | | | | | |

| | | |
|--|---------------|-------|
| | SPECIFICATION | PAGE |
| | TACT SWITCH | 3 / 5 |

5. DURABILITY

| | PROPERTY | TEST CONDITIONS | PERFORMANCE |
|-----|----------------|---|--|
| 5.1 | Operating life | <p>Measurements shall be made following the test set forth below :</p> <p>(1) DC 5V 5mA resistive load (2) Rate of operation : 2 ~ 3 operations per second (3) Depression : With a load of 150% of Actuating force (4) Cycles of operation : As per individual manufactured drawing.</p> | <ul style="list-style-type: none"> * Contact resistance : 10Ω Max * Insulation resistance : 10MΩ Min. * Bounce : 20m sec Max. * Operating force : within ± 30% of the initial value. * The requirement in item 3.2, 3.4 shall be satisfied. |

6. WEATHER PROOF

| | PROPERTY | TEST CONDITIONS | PERFORMANCE |
|-----|-----------------|--|---|
| 6.1 | Cold heat proof | <p>After testing at $-30\pm 2^{\circ}\text{C}$ for 96hours, the sample is allowed to stand under normal temperature and humidity conditions for 1 hour and measurement is performed within 1 hour after that.</p> <p>Waterdrops should be removed.</p> | <ul style="list-style-type: none"> * The requirement in item 3, 4 shall be satisfied. |
| 6.2 | Dry heat proof | <p>After testing at $85\pm 2^{\circ}\text{C}$ for 96hours, the sample is allowed to stand under normal temperature and for 1 hour and measurement is performed within 1 hour after that.</p> | |
| 6.3 | Damp heat proof | <p>After testing at $60\pm 2^{\circ}\text{C}$ and 90 ~ 95% in relative humidity for 96hours, the sample is allowed to stand under normal temperature and humidity conditions for 1 hour and measurement is performed within 1 hour after that.</p> <p>Waterdrops should be removed.</p> | <ul style="list-style-type: none"> * Contact resistance : 1Ω Max. * Insulation resistance : 10MΩ Min. * The requirement in item 3.2, 3.4, 3.5, 4 shall be satisfied. |

| | | | | | | | | | | |
|------|------|------|------|------|------|------|------|------|--------------|-----------------|
| | | | | | | APPD | CHKD | DSGN | TITLE | JTP 1158 SERIES |
| | | | | | | | | | DOCUMENT NO. | JT 0165 |
| ZONE | SYMB | DATE | APPD | CHKD | DSGD | | | | | |

| | | |
|--|---------------|-------|
| | SPECIFICATION | PAGE |
| | TACT SWITCH | 4 / 5 |

| | | | |
|-----|-----------------|---|--|
| 6.4 | Thermal cycling | <p style="text-align: center;">1 cycle</p> <p style="text-align: center;">+60°C</p> <p style="text-align: center;">-10°C</p> <p style="text-align: center;">2H 1H 2H 1H</p> <p>After the test conducted under 5 cycles the sample is allowed to stand under normal temperature and humidity conditions for 1 hour and the measurement is performed within 1 hour.</p> | * The requirement in item 3, 4 shall be satisfied. |
|-----|-----------------|---|--|

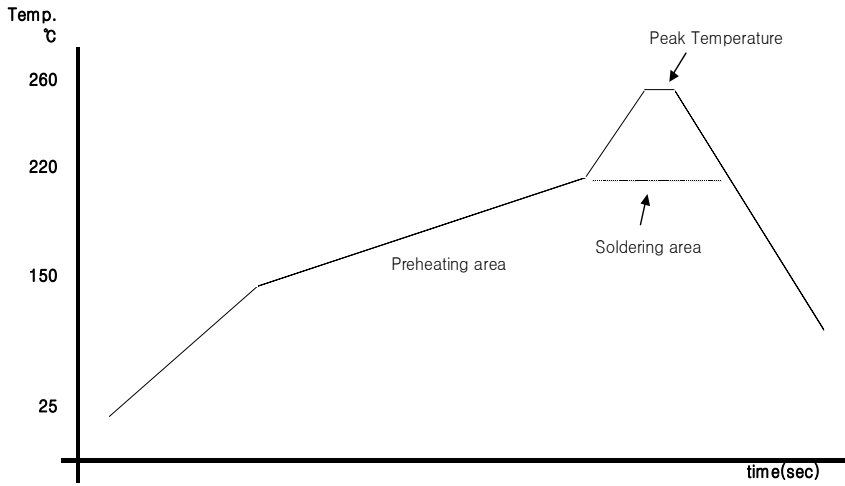
| | | | |
|-----|-----------|---|---|
| 6.5 | Salt mist | <p>Switch shall be checked after following test</p> <ol style="list-style-type: none"> (1) Temperature : $35 \pm 2^\circ\text{C}$ (2) Salt solution : $5 \pm 1\%$(Solids by weight) (3) Duration : 2 hr spray & 22 hr pause(Total 72 hr) (4) Leaving time after test : 1 hours (5) After the test, salt deposit should be removed in water and waterdrops should be removed. | * No remarkable corrosion shall be recongnized in metal part. |
|-----|-----------|---|---|

| | | | | | | | | | | |
|------|------|------|------|------|------|------|------|------|--------------|-----------------|
| | | | | | | APPD | CHKD | DSGN | TITLE | JTP 1158 SERIES |
| | | | | | | | | | DOCUMENT NO. | JT 0165 |
| ZONE | SYMB | DATE | APPD | CHKD | DSGD | | | | | |

| | | |
|--|---------------|-------|
| | SPECIFICATION | PAGE |
| | TACT SWITCH | 5 / 5 |

7.1 Reflow soldering conditions

- 1) Preheat ----- 150°C ~ 200°C, 120 ±20 (sec)
- 2) Peak temperature --- 260°C Max. 10 (sec)
- 3) Soldering area temperature ----- 217°C, 90 ~ 120 (sec)
- 4) The thickness of cream solder : 0.08mm



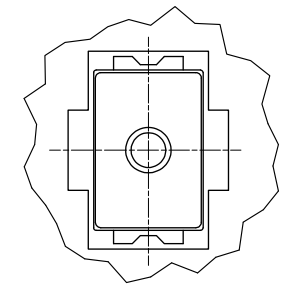
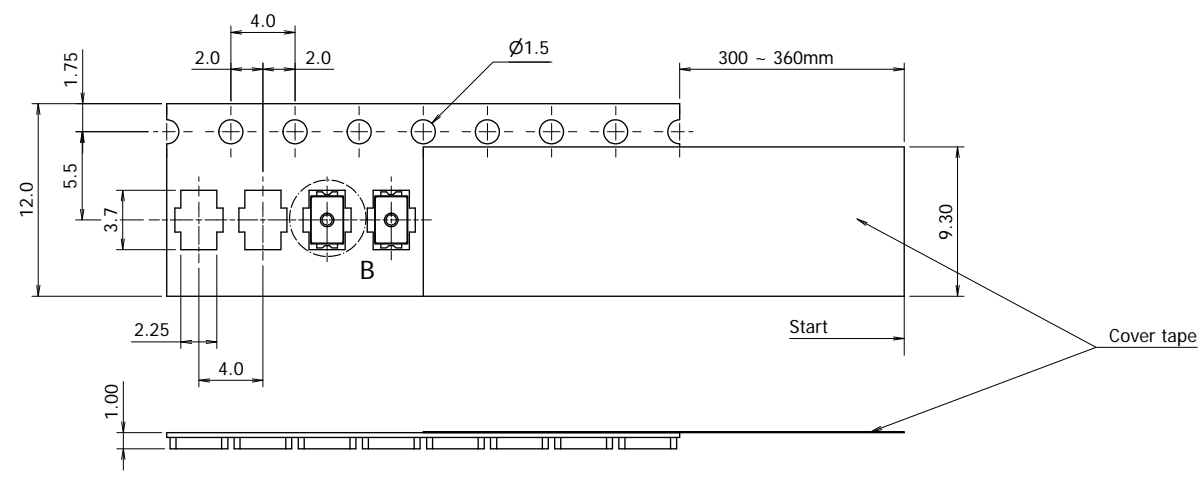
< Temperature profile >

7.2 Manual soldering conditions

- 1) Soldering temperature : 350°C Max.
- 2) Soldering time : 3 (sec) Max.

| | | | | | | | | | | |
|------|------|------|------|------|------|------|------|------|--------------|-----------------|
| | | | | | | APPD | CHKD | DSGN | TITLE | JTP 1158 SERIES |
| | | | | | | | | | DOCUMENT NO. | JT 0165 |
| ZONE | SYMB | DATE | APPD | CHKD | DSGD | | | | | |

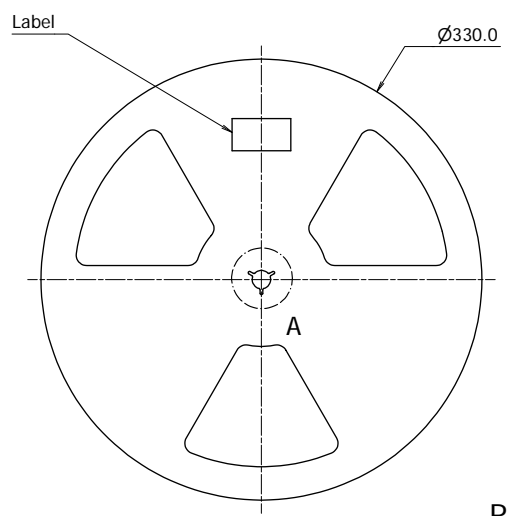
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| RevNO. | Revision note | Date | Signature |
| ▲ | | | |



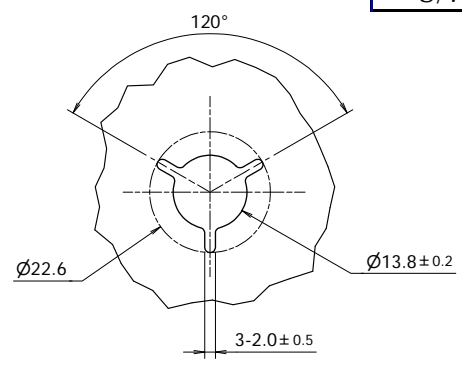
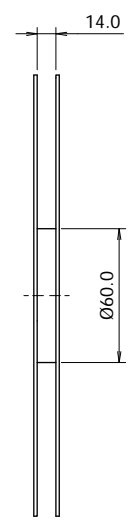
DETAIL OF B

CARRIER TAPE

| Packing Specification | | |
|-----------------------|-----------------|------------------------|
| Non-Pocket Portion | Trailer portion | 200mm [10 Pocket MIN.] |
| | Leader portion | 10 Pocket MIN. |
| S/W Packing Q'TY | | 17,000 pcs. |



REEL



DETAIL OF A

| | | |
|------------|--------------|---------|
| JTP1158PEM | | |
| JTP1158WEM | | |
| JTP1158EM | 110011158115 | |
| Model name | Code no. | Remarks |

| | | | | |
|----------------------|-----------------|-----------|---------------------|-----------------|
| Designed by B.SAGONG | | Scale N/S | | Date 2013.07.18 |
| Checked by | | Unit mm | Sheet 1/1 | Rev. 2 |
| Approved by T.H.OH | Item TACT S/W | | Drawing name | |
| | Model JTP1158EM | | CARRIER TAPE(ASS'Y) | |



JTP1158PEM – INSPECTION REPORT

TEST DATE : 2014.11.29 ~ 2014.12.08

| NO | INSPECTION ITEM | TEST CONDITION | RESULT |
|---------|------------------|-------------------------------|--------|
| 1 | Operating life | 300,000cycles (2cycles/sec) | OK |
| 2 | Cold heat proof | -40℃ for 96hrs. | OK |
| 3 | Dry heat proof | 90℃ for 120hrs. | OK |
| 4 | Damp heat proof | 60℃ 95% for 120hrs. | OK |
| 5 | Thermal cycling | 5cycles : -10℃ → 60℃ → -10℃ | OK |
| 6 | Salt mist | 35℃ for 72hrs.(Salinity : 5%) | OK |
| 7 | Reflow soldering | 260℃ for 10sec. | OK |
| Remarks | | | |

| | |
|---------|-----|
| Remarks | O.K |
|---------|-----|

| DSGD | CHKD | APPD |
|------|------|------|
| | | |

Operating life

| | | | |
|-------------|---|-----------|------------|
| MODEL | JTP1158EM | SPL Q'TY | 10 PCS |
| START DATE | 2014.11.29 | INSPECTOR | SEOMYUNYUN |
| FINISH DATE | 2014.12.02 | RESULT | OK |
| CONDITION | 300,000 cycles. | | |
| OBJECT | <input checked="" type="checkbox"/> Mass-producing MODEL <input type="checkbox"/> LPP MODEL <input type="checkbox"/> Quality Defected MODEL <input type="checkbox"/> Others MODEL | | |

| TEST CONDITION | | | Sample No. | | | | | | | | | | | | | RESULT |
|-----------------------|------|---------------|------------|------|------|------|------|------|------|------|------|------|------|------|------|--------|
| INSPECTION ITEM | SPEC | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | MAX | MIN | AVR | | |
| OPERATING FORCE | INI | 180+50/-50gf | 210 | 205 | 202 | 210 | 205 | 203 | 202 | 202 | 196 | 195 | 210 | 195 | 203 | OK |
| | AFT | ±30% | 197 | 190 | 195 | 199 | 193 | 195 | 196 | 189 | 188 | 193 | 199 | 188 | 194 | OK |
| CL | INI | 40gf(min.) | 95 | 95 | 97 | 102 | 101 | 91 | 98 | 95 | 92 | 92 | 102 | 91 | 96 | OK |
| | AFT | | 88 | 89 | 89 | 96 | 94 | 93 | 89 | 84 | 83 | 91 | 96 | 83 | 90 | OK |
| CLICK RATIO | INI | 40%(min.) | 54.8 | 53.7 | 52.0 | 51.4 | 50.7 | 55.2 | 51.5 | 53.0 | 53.1 | 52.8 | 55.2 | 50.7 | 52.8 | OK |
| | AFT | | 55.3 | 53.2 | 54.4 | 51.8 | 51.3 | 52.3 | 54.6 | 55.6 | 55.9 | 52.8 | 55.9 | 51.3 | 53.7 | OK |
| DIELECTRIC STRENGTH | INI | AC 250V 1min | OK | OK | OK | OK | OK | OK | OK | OK | OK | OK | | | | OK |
| | AFT | | OK | OK | OK | OK | OK | OK | OK | OK | OK | OK | OK | | | |
| INSULATION RESISTANCE | INI | DC 100V 100MΩ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | | | | OK |
| | AFT | DC 100V 10MΩ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | | | | OK |
| CONTACT RESISTANCE | INI | 500mΩ(max.) | 30.2 | 29.4 | 31.8 | 28.9 | 31.2 | 32.2 | 33.4 | 31.5 | 33.7 | 29.1 | 33.7 | 28.9 | 31.1 | OK |
| | AFT | 10Ω(max.) | 43.5 | 45.2 | 41.1 | 46.8 | 42.5 | 44.7 | 42.8 | 45.7 | 46.2 | 45.9 | 46.8 | 41.1 | 44.4 | OK |
| RESULT | O.K | | | | | | | | | | | | | | | |
| REMARK | | | | | | | | | | | | | | | | |

Cold heat proof

| | | | |
|-------------|---|-----------|------------|
| MODEL | JTP1158EM | SPL Q'TY | 10 PCS |
| START DATE | 2014.11.29 | INSPECTOR | SEOMYUNYUN |
| FINISH DATE | 2014.12.03 | RESULT | OK |
| CONDITION | -40℃ for 96hrs. | | |
| OBJECT | <input checked="" type="checkbox"/> Mass-producing MODEL <input type="checkbox"/> LPP MODEL <input type="checkbox"/> Quality Defected MODEL <input type="checkbox"/> Others MODEL | | |

| TEST CONDITION | | | Sample No. | | | | | | | | | | | | | RESULT |
|-----------------------|------|---------------|------------|------|------|------|------|------|------|------|------|------|------|------|------|--------|
| INSPECTION ITEM | SPEC | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | MAX | MIN | AVR | | |
| OPERATING FORCE | INI | 180+50/-50gf | 205 | 210 | 196 | 203 | 205 | 195 | 192 | 199 | 203 | 202 | 210 | 192 | 201 | OK |
| | AFT | | 203 | 207 | 195 | 200 | 202 | 196 | 193 | 195 | 198 | 197 | 207 | 193 | 199 | OK |
| CL | INI | 40gf(min.) | 95 | 94 | 91 | 96 | 98 | 98 | 95 | 99 | 99 | 91 | 99 | 91 | 96 | OK |
| | AFT | | 94 | 95 | 92 | 94 | 95 | 96 | 97 | 97 | 95 | 95 | 97 | 92 | 95 | OK |
| CLICK RATIO | INI | 40%(min.) | 53.7 | 55.2 | 53.6 | 52.7 | 52.2 | 49.7 | 50.5 | 50.3 | 51.2 | 55.0 | 55.2 | 49.7 | 52.4 | OK |
| | AFT | | 53.7 | 54.1 | 52.8 | 53.0 | 53.0 | 51.0 | 49.7 | 50.3 | 52.0 | 51.8 | 54.1 | 49.7 | 52.1 | OK |
| DIELECTRIC STRENGTH | INI | AC 250V 1min | OK | OK | OK | OK | OK | OK | OK | OK | OK | OK | | | | OK |
| | AFT | | OK | OK | OK | OK | OK | OK | OK | OK | OK | OK | OK | | | |
| INSULATION RESISTANCE | INI | DC 100V 100MΩ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | | | | OK |
| | AFT | | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | | | | OK |
| CONTACT RESISTANCE | INI | 500mΩ(max.) | 33.5 | 32.8 | 30.2 | 31.4 | 31.1 | 33.7 | 32.9 | 31.1 | 34.5 | 29.7 | 34.5 | 29.7 | 32.1 | OK |
| | AFT | | 32.0 | 32.2 | 31.5 | 32.3 | 32.9 | 32.7 | 33.4 | 32.6 | 33.8 | 30.8 | 33.8 | 30.8 | 32.4 | OK |
| RESULT | O.K | | | | | | | | | | | | | | | |
| REMARK | | | | | | | | | | | | | | | | |

Dry heat proof

| | | | |
|-------------|---|-----------|------------|
| MODEL | JTP1158EM | SPL Q'TY | 10 PCS |
| START DATE | 2014.11.29 | INSPECTOR | SEOMYUNYUN |
| FINISH DATE | 2014.12.04 | RESULT | OK |
| CONDITION | 90℃ for 120hrs. | | |
| OBJECT | <input checked="" type="checkbox"/> Mass-producing MODEL <input type="checkbox"/> LPP MODEL <input type="checkbox"/> Quality Defected MODEL <input type="checkbox"/> Others MODEL | | |

| TEST CONDITION | | | Sample No. | | | | | | | | | | | | | RESULT |
|-----------------------|------|---------------|------------|------|------|------|------|------|------|------|------|------|------|------|------|--------|
| INSPECTION ITEM | SPEC | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | MAX | MIN | AVR | | |
| OPERATING FORCE | INI | 180+50/-50gf | 191 | 205 | 196 | 195 | 192 | 200 | 203 | 206 | 205 | 195 | 206 | 191 | 199 | OK |
| | AFT | | 190 | 202 | 195 | 193 | 190 | 198 | 200 | 202 | 203 | 193 | 203 | 190 | 197 | OK |
| CL | INI | 40gf(min.) | 93 | 92 | 95 | 94 | 98 | 91 | 96 | 95 | 98 | 91 | 98 | 91 | 94 | OK |
| | AFT | | 94 | 93 | 96 | 95 | 95 | 92 | 94 | 92 | 96 | 92 | 96 | 92 | 94 | OK |
| CLICK RATIO | INI | 40%(min.) | 51.3 | 55.1 | 51.5 | 51.8 | 49.0 | 54.5 | 52.7 | 53.9 | 52.2 | 53.3 | 55.1 | 49.0 | 52.5 | OK |
| | AFT | | 50.5 | 54.0 | 50.8 | 50.8 | 50.0 | 53.5 | 53.0 | 54.5 | 52.7 | 52.3 | 54.5 | 50.0 | 52.2 | OK |
| DIELECTRIC STRENGTH | INI | AC 250V 1min | OK | OK | OK | OK | OK | OK | OK | OK | OK | OK | | | | OK |
| | AFT | | OK | OK | OK | OK | OK | OK | OK | OK | OK | OK | OK | | | |
| INSULATION RESISTANCE | INI | DC 100V 100MΩ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | | | | OK |
| | AFT | | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | | | |
| CONTACT RESISTANCE | INI | 500mΩ(max.) | 35.2 | 29.8 | 31.4 | 32.5 | 31.7 | 30.9 | 33.1 | 32.6 | 35.2 | 34.1 | 35.2 | 29.8 | 32.7 | OK |
| | AFT | | 34.5 | 31.0 | 30.9 | 33.4 | 33.5 | 31.8 | 34.2 | 33.7 | 32.6 | 35.2 | 35.2 | 30.9 | 33.1 | OK |
| RESULT | O.K | | | | | | | | | | | | | | | |
| REMARK | | | | | | | | | | | | | | | | |

Damp heat proof

| | | | |
|-------------|---|-----------|------------|
| MODEL | JTP1158EM | SPL Q'TY | 10 PCS |
| START DATE | 2014.12.03 | INSPECTOR | SEOMYUNYUN |
| FINISH DATE | 2014.12.08 | RESULT | OK |
| CONDITION | 60℃ 95% for 120hrs. | | |
| OBJECT | <input checked="" type="checkbox"/> Mass-producing MODEL <input type="checkbox"/> LPP MODEL <input type="checkbox"/> Quality Defected MODEL <input type="checkbox"/> Others MODEL | | |

| TEST CONDITION | | Sample No. | | | | | | | | | | | | | | RESULT |
|-----------------------|------|---------------|------|------|------|------|------|------|------|------|------|------|------|------|------|--------|
| INSPECTION ITEM | SPEC | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | MAX | MIN | AVR | | |
| OPERATING FORCE | INI | 180+50/-50gf | 202 | 205 | 207 | 202 | 210 | 192 | 196 | 193 | 192 | 198 | 210 | 192 | 200 | OK |
| | AFT | | 199 | 204 | 203 | 201 | 208 | 191 | 194 | 195 | 192 | 199 | 208 | 191 | 199 | OK |
| CL | INI | 40gf(min.) | 95 | 93 | 96 | 92 | 105 | 96 | 94 | 92 | 98 | 95 | 105 | 92 | 96 | OK |
| | AFT | | 96 | 95 | 94 | 94 | 102 | 98 | 95 | 90 | 97 | 93 | 102 | 90 | 95 | OK |
| CLICK RATIO | INI | 40%(min.) | 53.0 | 54.6 | 53.6 | 54.5 | 50.0 | 50.0 | 52.0 | 52.3 | 49.0 | 52.0 | 54.6 | 49.0 | 52.1 | OK |
| | AFT | | 51.8 | 53.4 | 53.7 | 53.2 | 51.0 | 48.7 | 51.0 | 53.8 | 49.5 | 53.3 | 53.8 | 48.7 | 51.9 | OK |
| DIELECTRIC STRENGTH | INI | AC 250V 1min | OK | OK | OK | OK | OK | OK | OK | OK | OK | OK | | | | OK |
| | AFT | | OK | OK | OK | OK | OK | OK | OK | OK | OK | OK | | | | OK |
| INSULATION RESISTANCE | INI | DC 100V 100MΩ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | | | | OK |
| | AFT | DC 100V 10MΩ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | | | | OK |
| CONTACT RESISTANCE | INI | 500mΩ(max.) | 33.9 | 32.5 | 32.1 | 32.7 | 30.8 | 34.7 | 35.2 | 30.5 | 31.4 | 33.2 | 35.2 | 30.5 | 32.7 | OK |
| | AFT | 1Ω(max.) | 34.8 | 34.2 | 33.5 | 34.9 | 32.2 | 35.1 | 34.6 | 32.8 | 33.1 | 32.7 | 35.1 | 32.2 | 33.8 | OK |
| RESULT | O.K | | | | | | | | | | | | | | | |
| REMARK | | | | | | | | | | | | | | | | |

Thermal cycling

| | | | |
|--------------|---|------------|------------|
| *MODEL | JTP1158EM | * SPL Q'TY | 10 PCS |
| *START DATE | 2014.12.04 | *INSPECTOR | SEOMYUNYUN |
| *FINISH DATE | 2014.12.05 | * RESULT | OK |
| *CONDITION | 5cycles : -10℃ → 60℃ → -10℃ | | |
| * OBJECT | <input checked="" type="checkbox"/> Mass-producing MODEL <input type="checkbox"/> LPP MODEL <input type="checkbox"/> Quality Defected MODEL <input type="checkbox"/> Others MODEL | | |

| TEST CONDITION | | | Sample No. | | | | | | | | | | | | | RESULT |
|-----------------------|------|---------------|------------|------|------|------|------|------|------|------|------|------|------|------|------|--------|
| INSPECTION ITEM | SPEC | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | MAX | MIN | AVR | | |
| OPERATING FORCE | INI | 180+50/-50gf | 199 | 201 | 203 | 192 | 210 | 202 | 205 | 208 | 196 | 191 | 210 | 191 | 201 | OK |
| | AFT | | 195 | 198 | 201 | 190 | 208 | 200 | 201 | 201 | 198 | 190 | 208 | 190 | 198 | OK |
| CL | INI | 40gf(min.) | 94 | 92 | 95 | 91 | 90 | 103 | 102 | 101 | 96 | 95 | 103 | 90 | 96 | OK |
| | AFT | | 95 | 95 | 100 | 92 | 92 | 100 | 99 | 98 | 95 | 94 | 100 | 92 | 96 | OK |
| CLICK RATIO | INI | 40%(min.) | 52.8 | 54.2 | 53.2 | 52.6 | 57.1 | 49.0 | 50.2 | 51.4 | 51.0 | 50.3 | 57.1 | 49.0 | 52.2 | OK |
| | AFT | | 51.3 | 52.0 | 50.2 | 51.6 | 55.8 | 50.0 | 50.7 | 51.2 | 52.0 | 50.5 | 55.8 | 50.0 | 51.5 | OK |
| DIELECTRIC STRENGTH | INI | AC 250V 1min | OK | OK | OK | OK | OK | OK | OK | OK | OK | OK | | | | OK |
| | AFT | | OK | OK | OK | OK | OK | OK | OK | OK | OK | OK | OK | | | |
| INSULATION RESISTANCE | INI | DC 100V 100MΩ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | | | | OK |
| | AFT | | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | | | |
| CONTACT RESISTANCE | INI | 500mΩ(max.) | 32.9 | 31.5 | 33.2 | 31.8 | 30.8 | 34.2 | 33.3 | 34.1 | 31.7 | 32.4 | 34.2 | 30.8 | 32.6 | OK |
| | AFT | | 35.2 | 33.4 | 35.9 | 33.1 | 35.2 | 36.7 | 35.7 | 36.2 | 33.9 | 35.5 | 36.7 | 33.1 | 35.1 | OK |
| RESULT | O.K | | | | | | | | | | | | | | | |
| REMARK | | | | | | | | | | | | | | | | |

Salt mist

| | | | |
|-------------|---|-----------|------------|
| MODEL | JTP1158EM | SPL Q'TY | 10 PCS |
| START DATE | 2014.12.02 | INSPECTOR | SEOMYUNYUN |
| FINISH DATE | 2014.12.05 | RESULT | OK |
| CONDITION | 35°C for 72hrs.(Salinity : 5%) | | |
| OBJECT | <input checked="" type="checkbox"/> Mass-producing MODEL <input type="checkbox"/> LPP MODEL <input type="checkbox"/> Quality Defected MODEL <input type="checkbox"/> Others MODEL | | |

| | |
|------------------------|-----|
| 시험 전/후 외관 부식 및 변색 없을 것 | |
| RESULT | O.K |
| REMARK | |

Reflow soldering

| | | | |
|-------------|---|-----------|------------|
| MODEL | JTP1158EM | SPL Q'TY | 10 PCS |
| START DATE | 2014.11.29 | INSPECTOR | SEOMYUNYUN |
| FINISH DATE | 2014.11.29 | RESULT | OK |
| CONDITION | 260℃ for 10sec. | | |
| OBJECT | <input checked="" type="checkbox"/> Mass-producing MODEL <input type="checkbox"/> LPP MODEL <input type="checkbox"/> Quality Defected MODEL <input type="checkbox"/> Others MODEL | | |

| TEST CONDITION | | Sample No. | | | | | | | | | | | | | | RESULT |
|-----------------------|------|------------|------|------|------|------|------|------|------|------|------|------|------|------|----|--------|
| INSPECTION ITEM | SPEC | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | MAX | MIN | AVR | | |
| OPERATING FORCE | INI | 209 | 192 | 210 | 205 | 202 | 210 | 206 | 208 | 203 | 194 | 210 | 192 | 204 | OK | |
| | 1회 | 205 | 194 | 205 | 202 | 208 | 205 | 203 | 205 | 205 | 198 | 208 | 194 | 203 | OK | |
| | 2회 | 208 | 193 | 207 | 208 | 205 | 211 | 205 | 206 | 208 | 199 | 211 | 193 | 205 | OK | |
| CL | INI | 95 | 96 | 95 | 92 | 98 | 106 | 105 | 102 | 102 | 93 | 106 | 92 | 98 | OK | |
| | 1회 | 90 | 92 | 93 | 91 | 95 | 105 | 103 | 105 | 103 | 94 | 105 | 90 | 97 | OK | |
| | 2회 | 93 | 95 | 95 | 92 | 99 | 102 | 101 | 102 | 99 | 98 | 102 | 92 | 98 | | |
| CLICK RATIO | INI | 54.5 | 50.0 | 54.8 | 55.1 | 51.5 | 49.5 | 49.0 | 51.0 | 49.8 | 52.1 | 55.1 | 49.0 | 51.7 | OK | |
| | 1회 | 56.1 | 52.6 | 54.6 | 55.0 | 54.3 | 48.8 | 49.3 | 48.8 | 49.8 | 52.5 | 56.1 | 48.8 | 52.2 | OK | |
| | 2회 | 55.3 | 50.8 | 54.1 | 55.8 | 51.7 | 51.7 | 50.7 | 50.5 | 52.4 | 50.8 | 55.8 | 50.5 | 52.4 | OK | |
| DIELECTRIC STRENGTH | INI | OK | OK | OK | OK | OK | OK | OK | OK | OK | OK | | | | OK | |
| | 1회 | OK | OK | OK | OK | OK | OK | OK | OK | OK | OK | | | | OK | |
| | 2회 | OK | OK | OK | OK | OK | OK | OK | OK | OK | OK | | | | | |
| INSULATION RESISTANCE | INI | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | | | | OK | |
| | 1회 | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | | | | OK | |
| | 2회 | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | ∞ | | | | | |
| CONTACT RESISTANCE | INI | 33.5 | 30.8 | 31.9 | 32.7 | 33.6 | 32.8 | 32.1 | 34.2 | 33.5 | 30.8 | 34.2 | 30.8 | 32.6 | OK | |
| | 1회 | 35.2 | 33.8 | 35.7 | 36.3 | 35.1 | 33.8 | 35.5 | 37.1 | 34.9 | 32.4 | 37.1 | 32.4 | 35.0 | OK | |
| | 2회 | 36.9 | 35.2 | 36.1 | 36.9 | 35.5 | 34.2 | 35.7 | 38.2 | 36.7 | 35.1 | 38.2 | 34.2 | 36.1 | OK | |
| RESULT | O.K | | | | | | | | | | | | | | | |
| REMARK | | | | | | | | | | | | | | | | |

재질 증명서

(CERTIFICATION OF MATERIAL)

| | | | |
|--------|----|----|----|
| 결 재 | 작성 | 검토 | 승인 |
| | | | |

일 자 2014년 12월 29일
DATE

제품명 TACT SWITCH
ITEM

제품 번호 JTP 1158P(EM)
MODEL No.

상기 제품은 하기재료를 사용하고 있음을 증명합니다.
(The above item is certified to use with following materials.)

| No. | 구성부품명 (Part name) | 원재료(Material) | | | | 난연성 (Flame class) | UL (File No.) | 색상 (Color) |
|-----|----------------------|--------------------|------------|-----------------------------------|-------------|-------------------------|------------------|---------------|
| | | Material name | Treatment | Manufacturer | Nationality | | | |
| 1 | CASE | LCP | | CELANESE INTERNATIONAL CORP | USA | UL 94V-0 | E83005 | BLACK |
| 2 | TERMINAL | PHOSPHOR BRONZE | Ag plating | LEE GU INDUSTIRAL | KOREA | | | |
| 3 | TAPE FILM | PEEK TAPE | | TAE KYUNG | KOREA | | | |
| 4 | EMBO FILM | PI FILM | | ISOFLEX | KOREA | | | |
| 5 | CONTACT | STAINLESS STEEL | Ag clad | POSCO | KOREA | | | |
| 6 | EPOXY | EPOXY | | THREE BOND | JAPAN | | | |
| 7 | | | | | | | | |
| 8 | | | | | | | | |
| 9 | | | | | | | | |
| 10 | | | | | | | | |
| 11 | | | | | | | | |
| 12 | | | | | | | | |
| 13 | | | | | | | | |
| 14 | | | | | | | | |
| 15 | | | | | | | | |
| 16 | | | | | | | | |



TEST REPORT

Applicant : ISOFLEX
Address : #637, Seoheung Techno Valley, 731-4, Wonsi-dong, Danwon-gu,
Ansan-si, Gyeonggi-do, Korea

Page: 1 of 5

Report No. RT14R-S0329-001-E

Date: Jan. 22, 2014

Sample Description : The following submitted sample(s) said to be:-

Name/Type of Product : Polyimide Film
Name of Material : Polyimide
Sample ID No. : RT14R-S0329-001
Item No. : PIF-HN
Manufacturer/Vender : ISOFLEX

Sample received : Jan. 17, 2014
Testing Date : Jan. 17, 2014 ~ Jan. 22, 2014

Test Type : RoHS wet chemical analysis
Test Method(s) : Please see the following page(s).
Test Result(s) : Please see the following page(s).

- * Note 1 : The test results presented in this report relate only to the object tested.
- * Note 2 : This report shall not be reproduced except in full without the written approval of the testing laboratory.
- * Note 3 : The item no. is assigned by client and indicated according to their requirement and guarantee letter.

Approved by,

Jade Jang / Lab. Technical Manager

Authorized by,

Bo Park / Lab. General Manager

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Ulsan Lab. Address : #340-2, Yongam-Ri, Chongryang-Myun, Ulju-Gun, Ulsan 689-865 Korea



TEST REPORT

Page: 2 of 5
Date: Jan. 22, 2014

Report No. RT14R-S0329-001-E

Sample ID No. : RT14R-S0329-001

Sample Description : Polyimide Film

| Test Item | Unit | Test Method | MDL | Result |
|--|-------|--|-----|--------|
| Cadmium (Cd) | mg/kg | With reference to IEC 62321-5 Edition 1.0 : 2013, by acid digestion and determined by ICP-OES | 0.5 | N.D. |
| Lead (Pb) | mg/kg | | 5 | N.D. |
| Mercury (Hg) | mg/kg | With reference to IEC 62321-4 Edition 1.0 : 2013, by acid digestion and determined by ICP-OES | 2 | N.D. |
| Hexavalent Chromium (Cr ⁶⁺) (For non-metal) | mg/kg | With reference to IEC 62321 Edition 1.0 : 2008, by alkaline digestion and determined by UV-VIS Spectrophotometer | 1 | N.D. |
| Polybrominated Biphenyl (PBBs) | | | | |
| Monobromobiphenyl | mg/kg | With reference to IEC 62321 Edition 1.0 : 2008, by solvent extraction and determined by GC/MS | 5 | N.D. |
| Dibromobiphenyl | mg/kg | | 5 | N.D. |
| Tribromobiphenyl | mg/kg | | 5 | N.D. |
| Tetrabromobiphenyl | mg/kg | | 5 | N.D. |
| Pentabromobiphenyl | mg/kg | | 5 | N.D. |
| Hexabromobiphenyl | mg/kg | | 5 | N.D. |
| Heptabromobiphenyl | mg/kg | | 5 | N.D. |
| Octabromobiphenyl | mg/kg | | 5 | N.D. |
| Nonabromobiphenyl | mg/kg | | 5 | N.D. |
| Decabromobiphenyl | mg/kg | | 5 | N.D. |
| Polybrominated Diphenyl Ether (PBDEs) | | | | |
| Monobromodiphenyl ether | mg/kg | With reference to IEC 62321 Edition 1.0 : 2008, by solvent extraction and determined by GC/MS | 5 | N.D. |
| Dibromodiphenyl ether | mg/kg | | 5 | N.D. |
| Tribromodiphenyl ether | mg/kg | | 5 | N.D. |
| Tetrabromodiphenyl ether | mg/kg | | 5 | N.D. |
| Pentabromodiphenyl ether | mg/kg | | 5 | N.D. |
| Hexabromodiphenyl ether | mg/kg | | 5 | N.D. |
| Heptabromodiphenyl ether | mg/kg | | 5 | N.D. |
| Octabromodiphenyl ether | mg/kg | | 5 | N.D. |
| Nonabromodiphenyl ether | mg/kg | | 5 | N.D. |
| Decabromodiphenyl ether | mg/kg | | 5 | N.D. |

Tested by : Seonae Kim, Hyojoo Kim, Misun Lee

Notes : mg/kg = ppm = parts per million
< = Less than
N.D. = Not detected (<MDL)
MDL = Method detection limit

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TEST REPORT

Page: 3 of 5
Date: Jan. 22, 2014

Report No. RT14R-S0329-001-E

Sample ID No. : RT14R-S0329-001

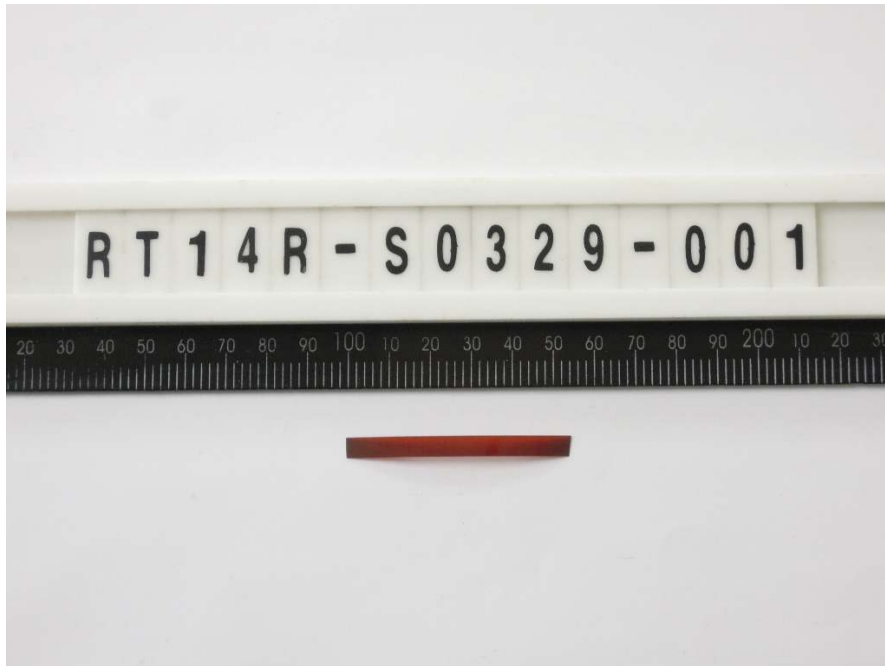
Sample Description : Polyimide Film

| Test Item | Unit | Test Method | MDL | Result |
|---------------|-------|---|-----|--------|
| Bromine (Br) | mg/kg | With reference to EN 14582, by oxygen combustion with bomb and determined by IC | 30 | N.D. |
| Chlorine (Cl) | mg/kg | With reference to EN 14582, by oxygen combustion with bomb and determined by IC | 30 | N.D. |
| Fluorine (F) | mg/kg | With reference to EN 14582, by oxygen combustion with bomb and determined by IC | 30 | N.D. |
| Iodine (I) | mg/kg | With reference to EN 14582, by oxygen combustion with bomb and determined by IC | 30 | N.D. |

Tested by : Chanoh Kim

Notes : mg/kg = ppm = parts per million
< = Less than
N.D. = Not detected (<MDL)
MDL = Method detection limit

* View of sample as received;-



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TEST REPORT

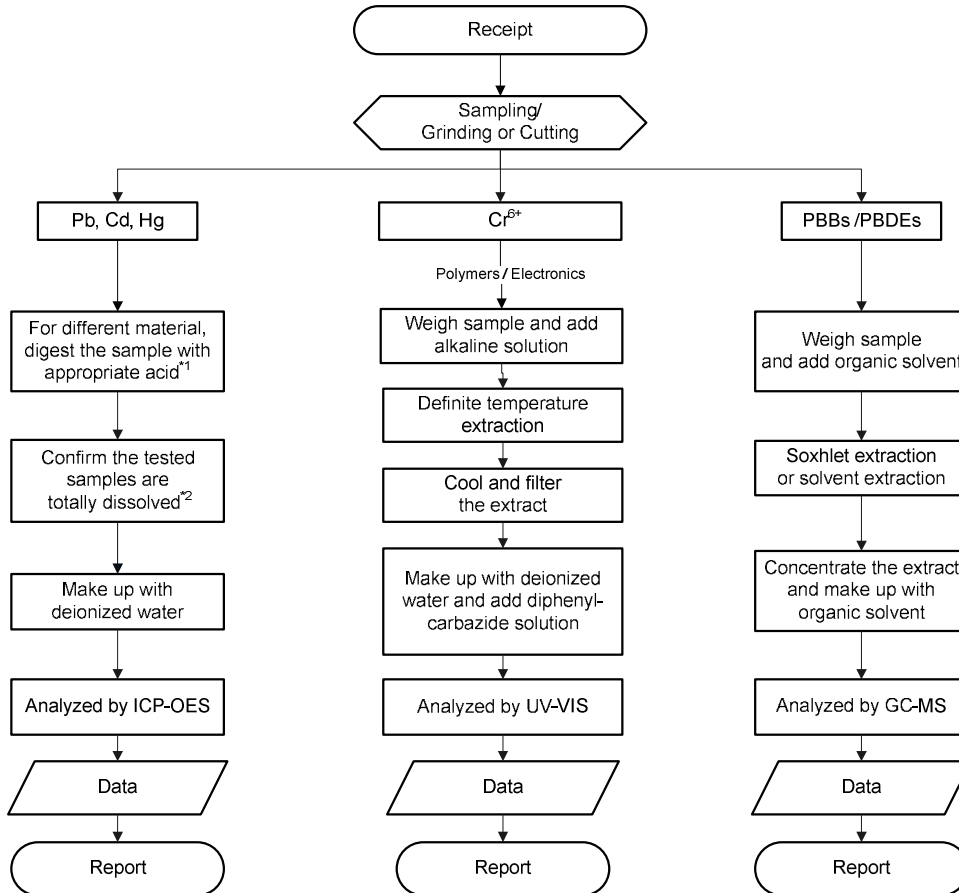
Report No. RT14R-S0329-001-E

Page: 4 of 5
Date: Jan. 22, 2014

Sample ID No. : RT14R-S0329-001

Sample Description : Polyimide Film

Flow Chart
(IEC 62321 Edition 1.0)



Remarks :

*1 : List of appropriate acid :

| Material | Acid added for digestion |
|-------------|--|
| Polymers | HNO ₃ , HCl, HF, H ₂ O ₂ , H ₃ BO ₃ |
| Metals | HNO ₃ , HCl, HF |
| Electronics | HNO ₃ , HCl, H ₂ O ₂ , HBF ₄ |

*2 : The samples were dissolved totally by pre-conditioning method according to above flow chart.

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TEST REPORT

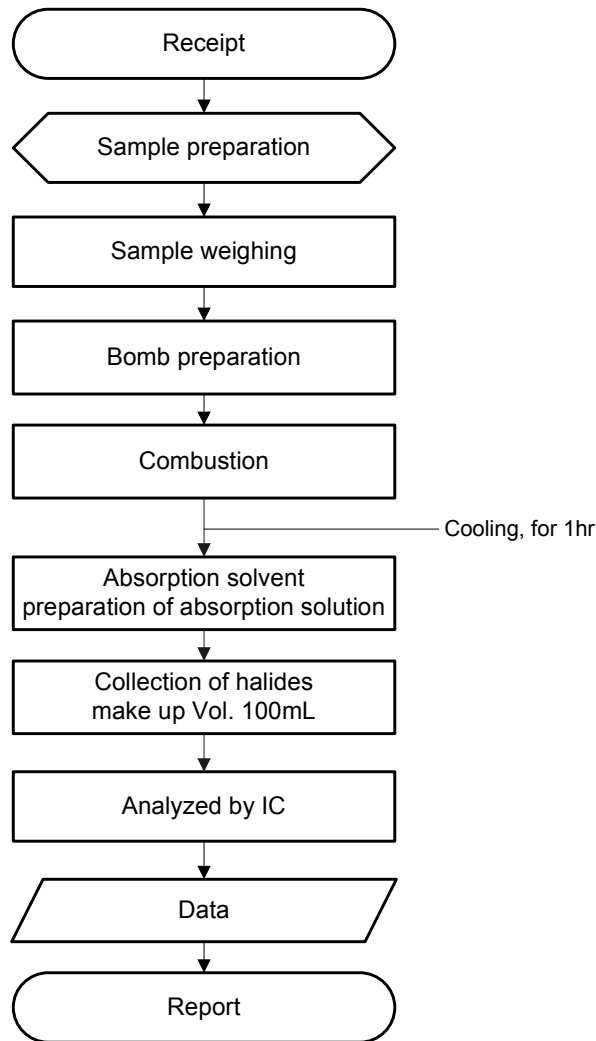
Report No. RT14R-S0329-001-E

Page: 5 of 5
Date: Jan. 22, 2014

Sample ID No. : RT14R-S0329-001

Sample Description : Polyimide Film

Flow Chart (Halogen)



***** End of Report *****

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Ulsan Lab. Address : #340-2, Yongam-Ri, Chongryang-Myun, Ulju-Gun, Ulsan 689-865 Korea



TEST REPORT

Applicant : ISOFLEX
Address : #637, Seoheung Techno Valley, 731-4, Wonsi-dong, Danwon-gu,
Ansan-si, Gyeonggi-do, Korea

Page: 1 of 3

Report No. RT14R-S4132-001-E

Date: Aug. 13, 2014

Sample Description : The following submitted sample(s) said to be:-

Name/Type of Product : Polyimide Film
Name of Material : Polyimide
Sample ID No. : RT14R-S4132-001
Item No. : PIF
Manufacturer/Vendor : ISOFLEX

Sample received : Aug. 08, 2014
Testing Date : Aug. 08, 2014 ~ Aug. 13, 2014

Test Method(s) : Please see the following page(s).
Test Result(s) : Please see the following page(s).

* Note 1 : The test results presented in this report relate only to the object tested.

* Note 2 : This report shall not be reproduced except in full without the written approval of the testing laboratory.

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Approved by,

Jade Jang / Lab. Technical Manager

Authorized by,

Bo Park / Lab. General Manager

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Ulsan Lab. Address : #340-2, Yongam-Ri, Chongryang-Myun, Ulju-Gun, Ulsan 689-865 Korea



TEST REPORT

Page: 2 of 3
Date: Aug. 13, 2014

Report No. RT14R-S4132-001-E

Sample ID No. : RT14R-S4132-001
Sample Description : Polyimide Film

| Test Item | Unit | Test Method | MDL | Result |
|---------------|-------|--|-----|--------|
| Antimony (Sb) | mg/kg | With reference to US EPA 3052, by acid digestion and determined by ICP-OES | 2 | N.D. |

Tested by : Yeonju Lee

Notes : mg/kg = ppm = parts per million
< = Less than
N.D. = Not detected (<MDL)
MDL = Method detection limit

* View of sample as received;-



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Ulsan Lab. Address : #340-2, Yongam-Ri, Chongryang-Myun, Ulju-Gun, Ulsan 689-865 Korea

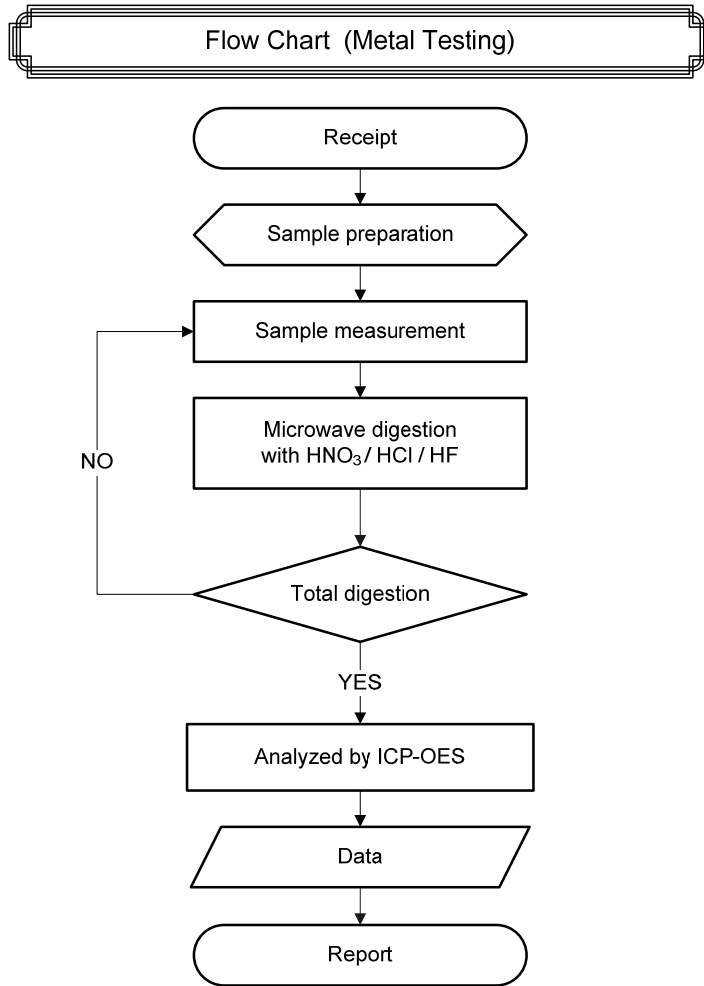


TEST REPORT

Page: 3 of 3
Date: Aug. 13, 2014

Report No. RT14R-S4132-001-E

Sample ID No. : RT14R-S4132-001
Sample Description : Polyimide Film



** Remarks : The samples were dissolved totally by pre-conditioning method according to above flow chart.

***** End of Report *****

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Ulsan Lab. Address : #340-2, Yongam-Ri, Chongryang-Myun, Ulju-Gun, Ulsan 689-865 Korea

Material Safety Data Sheet

Material Identification

Trade name: PIF

Company Identification

SUPPLIER: [Banwol Industrial Complex 4B-14] 637, Seoheung Techno Valley, 731-4, Wonsi-dong, Danwon-gu, Ansan-si, Gyeonggi-do, 425-851 Korea
Tel: +82-70-8299-8684 Fax: +82-31-629-6070
e-mail: info@isoflex.kr info@polyimide.kr
Web: www.isoflex.kr www.polyimide.kr

COMPOSITION/INFORMATION ON INGREDIENTS

Components

Material: POLYIMIDE FILM
Exposure limits for the following may apply: Polyimide Resin CAS: 62929-02-6 93%-95%
DMAC (Dimethylacetamide) CAS: 127-19-5 5%-7%

HAZARDS IDENTIFICATION

Potential Health Effects Before using films, read the following information on safe handling and use.
INHALATION: Not a probable route of exposure for film..
SKIN CONTACT: No irritation is expected from handling film.
Less than 1 ppm dimethyl acetamide was extracted from film by distilled water at 40 deg C for 4 hours
EYE CONTACT: Not a probable route of exposure for film.
INGESTION: Not a probable route of exposure for film.

FIRST AID MEASURES

First Aid

INHALATION: Not a probable route of exposure for film.
SKIN CONTACT: Wash with soap and water after handling. If skin irritation develops, consult a physician.
EYE CONTACT: Flush eyes with water. Consult a physician if irritation persists.

HANDLING AND STORAGE

Handling (Personnel): Wash thoroughly after handling.
Storage: Store away from flammable materials.

EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls: Safe handling of films at high Temperatures (above 240deg C) requires adequate ventilation. If small quantities of films are involved, normal air circulation may be all that is needed in case of overheating. Whether or existing ventilation is adequate at higher temperatures will depend on the combined factors of film quantity, temperature and exposure time.
Personal Protective Equipment: Safety glasses are recommended as good industrial practice.
Respirators are not needed for normal use.
Special protective clothing is not needed for normal use.
Gloves are recommended as good industrial practice.

PHYSICAL AND CHEMICAL PROPERTIES

Physical Data

| | |
|----------------------|------------------|
| Melting Point: | None |
| % Volatiles: | 1% max |
| Solubility in Water: | Insoluble |
| Odor: | No odor |
| Form: | Transparent film |
| Color: | Light amber |

Validity

| | |
|-----------------|-----------|
| Stock Validity: | 24 months |
|-----------------|-----------|

STABILITY AND REACTIVITY

| | |
|---------------------|---|
| Chemical Stability: | Stable at normal temperatures and storage conditions. |
|---------------------|---|

OTHER INFORMATION

Additional Information

| | |
|--------------|---|
| MEDICAL USE: | CAUTION: Do not use in medical applications involving permanent implantation in the human body. |
|--------------|---|

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process. This information is based upon technical information believed to be reliable.

THE END.



Test Report No. F690101/LF-CTSAYAA14-10894

Issued Date : 2014. 02. 26

Page 1 of 5

TAEKYUNG FNC CO., LTD.
#502 Chumdan venture valley, Gosaek-dong
Suwon-si, Gyeonggi-do
Korea

The following sample(s) was/were submitted and identified by/on behalf of the client as:-

SGS File No. : AYAA14-10894
Product Name : PEEK FILM
Item No./Part No. : APTIV 2000
Buyer(s) : SAMSUNG ELECTRONICS
Received Date : 2014. 02. 21
Test Period : 2014. 02. 24 to 2014. 02. 26
Test Results : For further details, please refer to following page(s)

SGS Korea Co., Ltd.

Jeff Jang / Chemical Lab Mgr

The results shown in this test report refer only to the sample(s) submitted by the client, not cover the quality of the whole batch. This report should be used as intended, and shall not be used for advertisement and lawsuit.

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Test Report No. F690101/LF-CTSAYAA14-10894

Issued Date : 2014. 02. 26

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Sample No. : AYAA14-10894.001
Sample Description : PEEK FILM
Item No./Part No. : APTIV 2000
Materials : N/A

Heavy Metals

| Test Items | Unit | Test Method | MDL | Results |
|-----------------------------|-------|--|-----|---------|
| Cadmium (Cd) | mg/kg | With reference to IEC 62321:2013, ICP | 0.5 | N.D. |
| Lead (Pb) | mg/kg | With reference to IEC 62321:2013, ICP | 5 | N.D. |
| Mercury (Hg) | mg/kg | With reference to IEC 62321:2013, ICP | 2 | N.D. |
| Hexavalent Chromium (Cr VI) | mg/kg | With reference to IEC 62321:2008, UV-VIS | 1 | N.D. |

Flame Retardants-PBBs/PBDEs

| Test Items | Unit | Test Method | MDL | Results |
|--------------------------|-------|---|-----|---------|
| Monobromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Dibromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Tribromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Tetrabromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Pentabromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Hexabromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Heptabromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Octabromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Nonabromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Decabromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Monobromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Dibromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Tribromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Tetrabromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Pentabromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Hexabromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Heptabromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Octabromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Nonabromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Decabromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |

Halogen Contents

| Test Items | Unit | Test Method | MDL | Results |
|--------------|-------|---------------------------------------|-----|---------|
| Bromine(Br) | mg/kg | With reference to ASTM D 7359-08 , IC | 30 | N.D. |
| Chlorine(Cl) | mg/kg | With reference to ASTM D 7359-08 , IC | 30 | N.D. |

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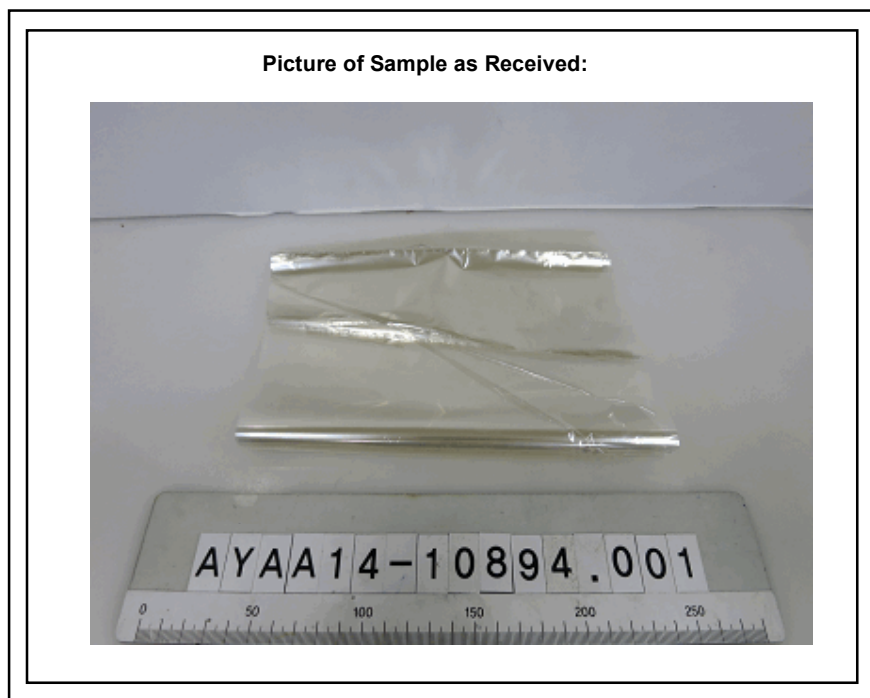


Test Report No. F690101/LF-CTSAYAA14-10894

Issued Date : 2014. 02. 26

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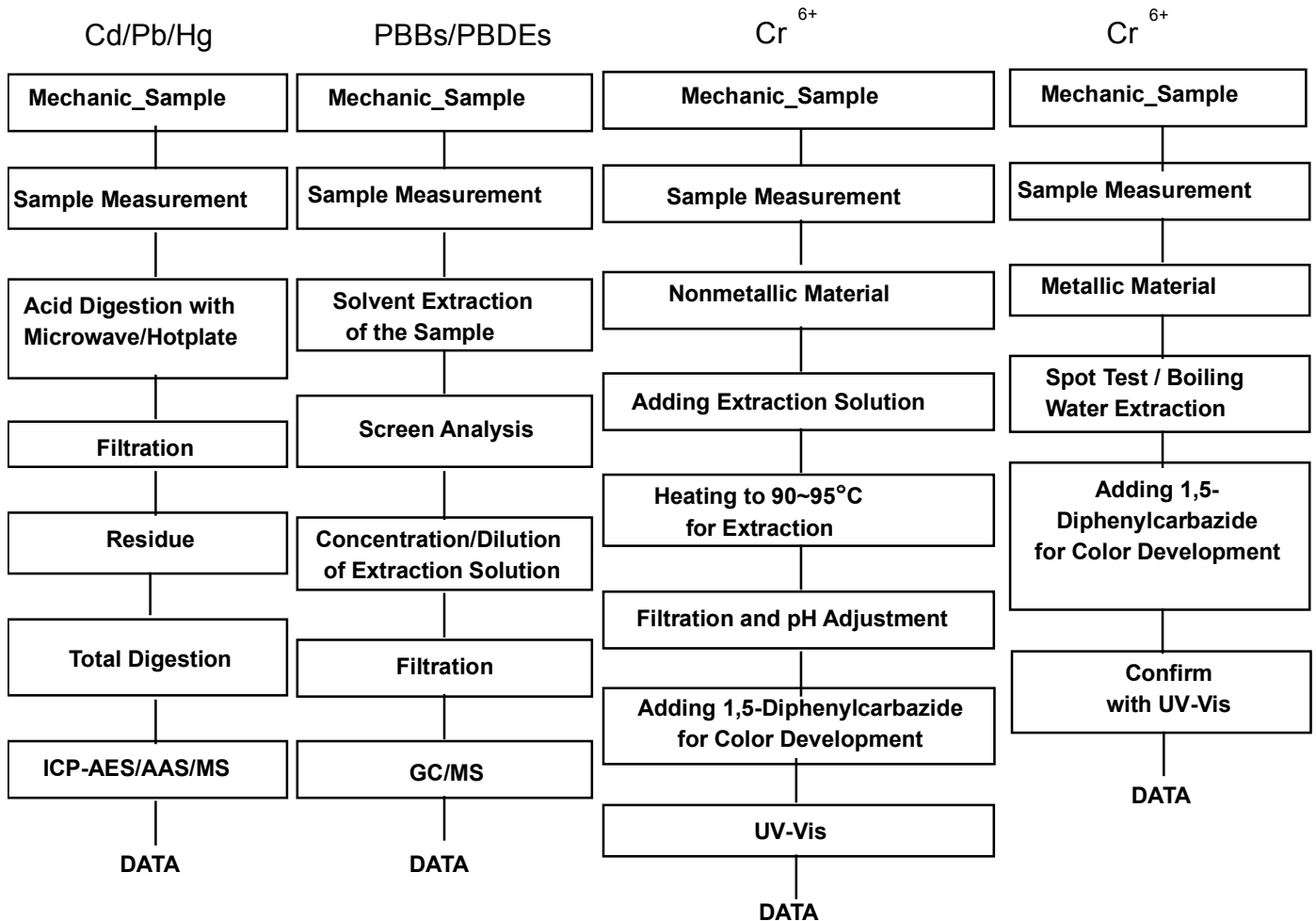
- NOTE:
- (1) N.D. = Not detected.(<MDL)
 - (2) mg/kg = ppm
 - (3) MDL = Method Detection Limit
 - (4) - = No regulation
 - (5) Negative = Undetectable / Positive = Detectable
 - (6) ** = Qualitative analysis (No Unit)
 - (7) * = Boiling-water-extraction:
 - Negative = Absence of CrVI coating
 - Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm² sample surface area.



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Testing Flow Chart for RoHS:Cd/Pb/Hg/Cr⁶⁺ /PBBs/PBDEs Testing

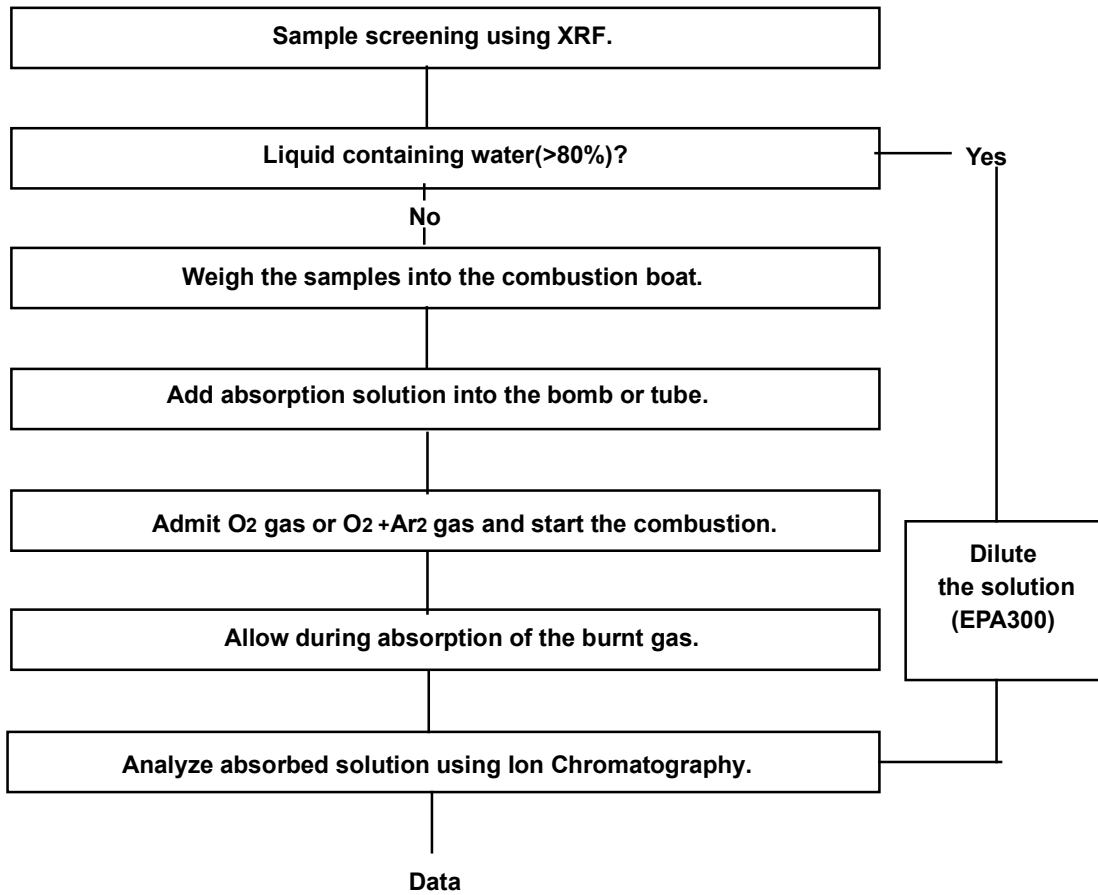


The samples were dissolved totally by pre-conditioning method according to above flow chart for Cd,Pb,Hg.
 Section Chief : Gilsae Yi

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Flow Chart for Halogen Test



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VICTREX® PEEK™ FILM TECHNOLOGY

Revision: 02.04.08 (Replaces 01.01.07)
Grade name: APTIV™ Film Grades: 1000 and 2000

SAFETY DATA SHEET

ACCORDING TO EC-REGULATIONS 91/155/EEC, 2006/1907/EC and 2006/121/EC

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND COMPANY/UNDERTAKING

Identification of the substance or preparation: APTIV™ Film Grades: 1000 and 2000

Company Identification: Victrex Plc, Victrex Technology Centre, Hillhouse International, Thornton-Cleveleys, Lancs, FY5 4QD, UK

Telephone: ++ 44 (0) 1253 897700

Fax: ++ 44 (0) 1253 897701

Emergency Phone No. ++ 44 (0) 1253 897754

Use of Substance / Preparation: The materials are generally used for film applications.
This material is not for human implantation.

2. HAZARDS IDENTIFICATION

EC Classification Not classified as dangerous for supply/use.

Product will burn in fire.

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Preparation consisting of:

Polyetheretherketone (CAS No. 31694-16-3).

| HAZARDOUS INGREDIENT(S) | %W/W | CAS No. | EC No. | EC Classification |
|-------------------------|------|---------|--------|-------------------|
| None. | - | - | - | - |

4. FIRST AID MEASURES



4.1 Inhalation

Remove patient from exposure. Keep patient at rest and give oxygen if breathing difficult. If symptoms develop, obtain medical attention.

4.2 Skin Contact

After contact with skin, wash immediately with plenty of soap and water.
In the event of contact with molten product: Cool affected area quickly with water. Do not attempt to remove hardened product. Obtain medical attention.

APTIV™ Film Grades: 1000 and 2000

| | |
|--|---|
| 4.3 Eye Contact | Irrigate with eyewash solution or clean water, holding the eyelids apart, for at least 15 minutes. If symptoms persist, obtain medical attention. |
| 4.4 Ingestion | Unlikely to be hazardous if swallowed. |
| 4.5 Further Medical Treatment | Unlikely to be required but if necessary treat symptomatically. |
| 4.6 Special resources necessary for first aid | None. |

5. FIRE-FIGHTING MEASURES

| | |
|--|--|
| 5.1 Extinguishing Media | As appropriate for surrounding fire. Extinguish with carbon dioxide, dry chemical, foam or waterspray. |
| 5.2 Unsuitable Extinguishing Media | None known. |
| 5.3 Fire Fighting Protective Equipment | Protective respirator with independent air supply. Full protection, if necessary. |
| 5.4 Special exposure hazards arising from the substance or preparation itself, combustion product, resulting gases. | In case of fire the following can develop: Oxides of carbon. Product will burn, but smoke emission is low. Dust is ignitable but will not sustain combustion. A high temperature source of ignition is required. The minimum spark energy required for ignition of a dust cloud is greater than 5000 mJ. It will not train fire, e.g. along beams etc. |
| 5.5 Other | Dispose of contaminated extinction water according to official regulations. |

6. ACCIDENTAL RELEASE MEASURES

Refer to Section 13 and for personal protection refer to section 8

| | |
|--|---|
| 6.1 Personal Precautions | Avoid inhalation and contact with eyes or skin. Ensure sufficient supply of air. Avoid build up of dust. Remove possible cause of ignition – do not smoke. Take precautionary measures against static discharges. |
| 6.2 Environmental Exposure Controls | Avoid release to the environment. Prevent surface and ground water infiltration, as well as ground penetration. |
| 6.3 Methods for cleaning up | Collect mechanically and dispose of according to Section 13. Avoid build up of dust. |

7. HANDLING AND STORAGE

| | |
|---------------------|--|
| 7.1 HANDLING | See Section: 6.1 General hygiene measures for the handling of chemicals are applicable. When using do not smoke. Eating, drinking, smoking, as well as food storage, is prohibited in work room. Avoid build up of dust. Local Exhaust Ventilation at the workplace or on the processing machines required. Note: Danger of explosive dust. |
| 7.2 STORAGE | Requirements for storage rooms and containers: Store in dry place. Not to be stored in gangways or stair wells. Store products enclosed, in original packing. See Section: 10.2. Storage Temperature: Ambient. Storage Life: Stable at ambient temperatures. Specific use: Industrial use only. |

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Ensure adequate ventilation. This can be achieved by local exhaust ventilation or general ventilation. If this is insufficient to maintain the concentration under the WEL or TRGS 900 values, suitable breathing protection should be worn. Applies only if maximum permissible exposure values are listed here.

APTIV™ Film Grades: 1000 and 2000

OCCUPATIONAL EXPOSURE LIMITS

| SUBSTANCE. | CAS No. | LTEL (8 hr TWA ppm) | LTEL (8 hr TWA mg/m³) | STEL (ppm) | STEL (mg/m³) | Note: |
|----------------------------------|---------|------------------------|--------------------------|------------|-----------------|------------------|
| Dust. (general dust limit value) | - | | 10 | | | Inhalable Dust. |
| | | | 4 | | | Respirable Dust. |

WEL: Workplace Exposure Limit (UK HSE EH40)



8.1 Respirators

If above exposure limits are likely to be exceeded, breathing mask with fine dust filter (EN 143)



8.2 Eye Protection

Eye protection with side protection (EN 166)



8.3 Gloves

Impervious Gloves. Plastic or synthetic rubber gloves.
Additional information on hand protection – No tests have been performed.
When dealing with heated material: Insulating gloves EN 407 (heat).

8.4 Other

Protective working garments (e.g. safety shoes EN 344, long sleeved protective working garments).

9. PHYSICAL AND CHEMICAL PROPERTIES

| | |
|---------------------------------------|---|
| Form | Solid. |
| Colour | Grey. Brown. |
| Odour | Odourless. |
| pH (Value) | Not known. |
| Boiling Point (°C) | Not known. |
| Melting Point (°C) | 343 |
| Flash Point (°C) | Not known. |
| Auto Ignition Temperature (°C) | 595 |
| Explosive Properties | May form explosible dust clouds in air. |
| Oxidising Properties | Not applicable. |
| Vapour Pressure (Pascal) | Not known. |
| Density (g/ml) | ~ 1.3 |
| Solubility (Water) | Not applicable. |

10. STABILITY AND REACTIVITY

| | |
|--|--|
| 10.1 Conditions to avoid | See Section: 7. Stable when handled and stored correctly. Electrostatic charge. Open flame, ignition sources. Decomposes at temperatures above (°C): 450. |
| 10.2 Materials to avoid | See Section: 7. Concentrated Sulphuric acid. |
| 10.3 Hazardous Decomposition Product(s) | See Section: 5.4 |

11. TOXICOLOGICAL INFORMATION

This material is unlikely to present a significant health hazard under normal conditions of handling and use.

| | |
|--------------------------|---|
| 11.1 Ingestion | Unlikely to cause harmful effects. |
| 11.2 Inhalation | Unlikely to be hazardous by inhalation unless present as a dust. Dust may cause irritation. |
| 11.3 Skin Contact | Unlikely to cause skin irritation. In the event of contact with molten product: |

APTIV™ Film Grades: 1000 and 2000

| | |
|-------------------------|--|
| 11.4 Eye Contact | Thermal Burns (molten polymer will adhere to skin and cause severe burns). Dust may have irritant effect on eyes. Permanent damage is unlikely. |
| 11.5 Long Term Exposure | Chronic effects are unlikely. |

12. ECOLOGICAL INFORMATION

| | |
|--|--|
| 12.1 Environmental Fate and Distribution | Solid insoluble in water. |
| 12.2 Persistence and Degradation | The product is not biodegradable. |
| 12.3 Toxicity | Low toxicity to aquatic organisms. |
| 12.4 Effect on Effluent Treatment | Unlikely to affect biological treatment processes. |
| 12.5 Water hazard class: | Not classified. |

13. DISPOSAL CONSIDERATIONS

| | |
|-----------------------------|---|
| 13.1 Regulatory information | Disposal should be in accordance with local, state or national legislation. |
| 13.2 E.C disposal code no: | The waste codes are recommendations based on the scheduled use of this product. For alternative uses and applications, other waste codes may be allocated under certain circumstances. 07 02 13 - waste plastic. 07 02 99 - waste not otherwise specified. |
| 13.3 Recommended: | Ensure that all packaging is disposed of safely. |

14. TRANSPORT INFORMATION

International Transport Regulations

Not classified as dangerous for transport.

| | |
|----------------------|-----------------|
| UN No.: | Not applicable. |
| Road/Rail (ADR/RID): | Not applicable. |
| Class/Packing Group: | Not applicable. |
| Classification code: | Not applicable. |
| LQ: | Not applicable. |
| EmS: | Not applicable. |

15. REGULATORY INFORMATION

Classification according to Dangerous Product Regulations incl. EC Directives 67/548/EEC, 1999/45/EC and 2006/121/EC.

| | |
|----------------------|---|
| EC Classification | Not classified as dangerous for supply/use. |
| Hazard Symbol | Not applicable. |
| Risk Phrases | Not applicable. |
| Safety Phrases | Not applicable. |
| Observe restrictions | VOC 1999/13/EC |

INTERNATIONAL INVENTORIES

| | |
|-----------------|-------------------------|
| EINECS (Europe) | EINECS: Not applicable. |
|-----------------|-------------------------|

16. OTHER INFORMATION

Manufactured in the UK under a Quality System approved to ISO 9001:2000 by Victrex Plc.

This Safety Data Sheet was prepared in accordance with Directive 2001/58/EC.

The following sections contain revisions or new statements: 1 - 16

APTIV™ Film Grades: 1000 and 2000

GLOSSARY

WEL: Workplace Exposure Limit (UK HSE EH40) / Bmgv: Biological monitoring guidance value (UK HSE EH40) / EH40 – UK Occupational Exposure Limits.

Risk Phrases:

None.

Additional information on the properties, processing and application of VICTREX polymers is available at www.victrex.com.

These details refer to the product as it is delivered.

Storage class VCI (Germany): 11/13

The statements made here should describe the product with regard to the necessary safety precautions – they are not meant to guarantee definite characteristics – but they are based on our present up-to-date knowledge.

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Test Report

| | |
|-------------------------------|---|
| Applicant Name : | VT COMPOSITE Co., LTD. |
| Address : | #927 Ilsan Techno Town, Baekseok 1-dong, Ilsan dong-gu, Goyang-si, Gyeonggi-do, Korea |
| Test Report No. : | CTK1409-RS-0009 |
| Date of Issue : | Sep. 17, 2014 |
| Sample Name : | VT4605C, VT4610C, VT4615C, VT4620C, VT4630C |
| Sample Received : | Sep. 15, 2014 |
| Test Performing Date : | Sep. 17, 2014 |
| Test Performed : | CTK Co., Ltd. tested the sample and item(s) which were selected by applicant with following result. |
| Test Results : | Refer to following page. |
| Tested by |  Ho Jung Kim |
| Reviewed by |  Hyo Seuk Jang / Lab. Manager |

1. TEST RESULTS

1) VT4605C, VT4610C, VT4615C, VT4620C, VT4630C

| Heavy Metals | | | | |  |
|------------------|--------------------------|--------------|--------------|---------------------|--|
| Test Item | Unit | Test Results | MDL | Test Methods | |
| Pb | mg/kg | N.D | 5.0 | IEC 62321 : 2008 | |
| Cd | | N.D | 0.5 | | |
| Hg | | N.D | 1.0 | | |
| Cr ⁶⁺ | | N.D | 0.2 | | |
| Sb | | N.D | 5.0 | US EPA 3050B : 1996 | |
| Flame Retardants | | | | | |
| Test Item | | Unit | Test Results | MDL | Test Methods |
| PBBs | Bromobiphenyl | mg/kg | N.D | 20.0 | IEC 62321 : 2008 |
| | Dibromobiphenyl | | N.D | 20.0 | |
| | Tribromobiphenyl | | N.D | 20.0 | |
| | Tetrabromobiphenyl | | N.D | 20.0 | |
| | Pentabromobiphenyl | | N.D | 20.0 | |
| | Hexabromobiphenyl | | N.D | 20.0 | |
| | Heptabromobiphenyl | | N.D | 20.0 | |
| | Octabromobiphenyl | | N.D | 20.0 | |
| | Nonabromobiphenyl | | N.D | 20.0 | |
| | Decabromobiphenyl | | N.D | 50.0 | |
| PBDEs | Bromodiphenyl ether | mg/kg | N.D | 20.0 | IEC 62321 : 2008 |
| | Dibromodiphenyl ether | | N.D | 20.0 | |
| | Tribromodiphenyl ether | | N.D | 20.0 | |
| | Tetrabromodiphenyl ether | | N.D | 20.0 | |
| | Pentabromodiphenyl ether | | N.D | 20.0 | |
| | Hexabromodiphenyl ether | | N.D | 20.0 | |
| | Heptabromodiphenyl ether | | N.D | 20.0 | |
| | Octabromodiphenyl ether | | N.D | 20.0 | |
| | Nonabromodiphenyl ether | | N.D | 20.0 | |
| | Decabromodiphenyl ether | | N.D | 50.0 | |

Test Report No. : CTK1409-RS-0009

page : 2 of 4

Date of issue : Sep. 17, 2014

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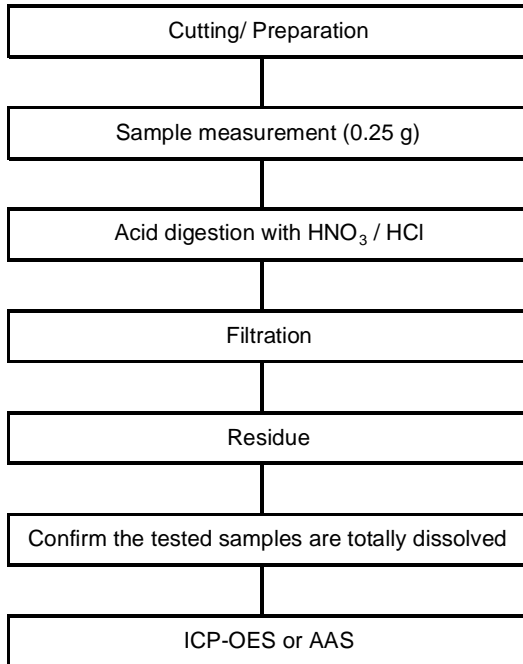
- VT4605C, VT4610C, VT4615C, VT4620C, VT4630C

| Halogen contents | | | | |
|------------------|-------|--------------|------|-----------------|
| Test Item | Unit | Test Results | MDL | Test Methods |
| Fluorine (F) | mg/kg | N.A | 50.0 | EN 14582 : 2007 |
| Chlorine (Cl) | | N.D | 50.0 | |
| Bromine (Br) | | N.D | 50.0 | |
| Iodine (I) | | N.A | 50.0 | |

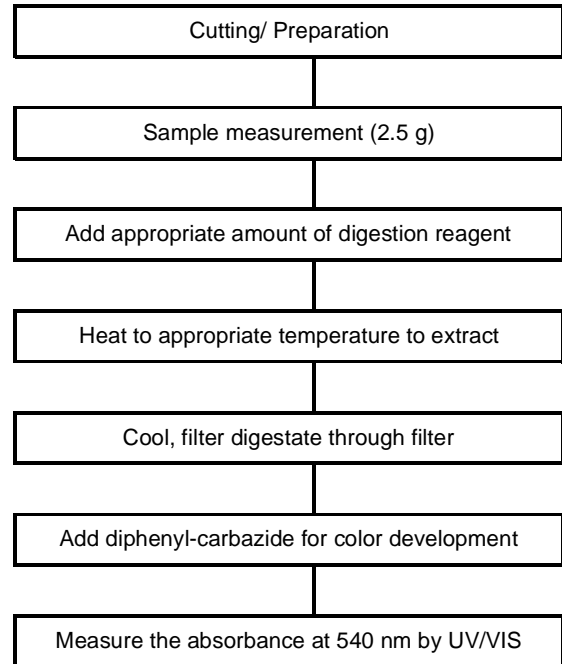
* MDL : Method Detection limit, N.D : Not Detected, N.A : Not Applicable

2. Flow Chart

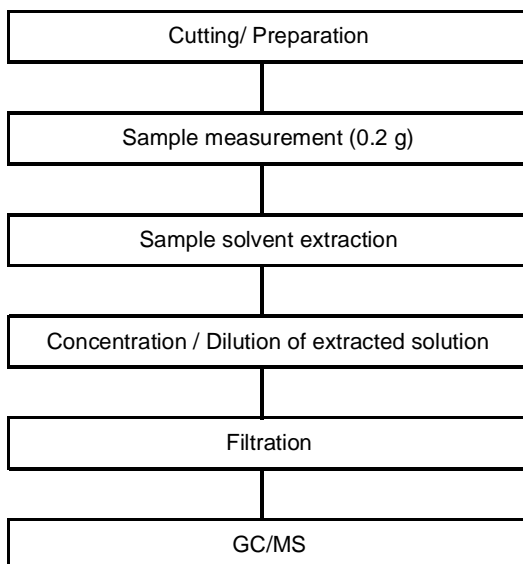
Digestion for material_ IEC 62321 for Pb, Cd, Hg and US EPA 3050B for Sb



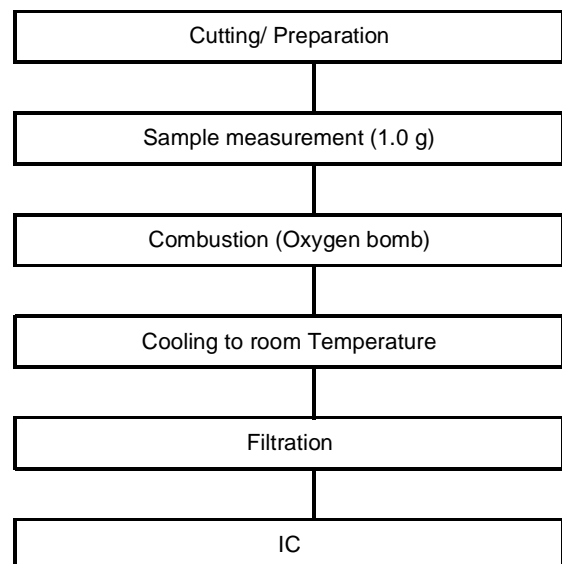
Extraction for polymer_ IEC 62321 for Cr⁶⁺



Extraction for polymer_ IEC 62321 for PBBs, PBDEs



Oxygen bomb for halogen_ EN 14582



- End of Report -

MATERIAL SAFETY DATA SHEET

Page 1 of 3

Date Prepared: 2014-Sep-5th

MSDS No: VT4610C High Performance Adhesive Transfer Tape

1. Chemical Product and Company Identification

Product Identifier: VT4610C

Product Code: VT4610C

Manufacturer:
V.T.Composite
#927 Ilsan Technotown, Baeksuk-dong
Ilsan-gu, Goyang-si, Seoul, Korea

Emergency Telephone Numbers:
82-2-3665-9331 ext. 226
Fax 82-2-3665-9338

2. Composition/Information on Ingredients

| CHEMICAL NAME | CAS-NO. | Portion(%) | | Weight(g/m ²) |
|--------------------|------------|------------|---------------|---------------------------|
| | | with liner | without Liner | |
| Acrylic Co-polymer | 9017-68-9 | 7.88 | 94.12 | 12.00 |
| Modified Tackifier | 65997-05-9 | 0.33 | 3.92 | 0.50 |
| 1-isocyanatobutane | 111-36-4 | 0.16 | 1.96 | 0.25 |
| Liner 1 | PET | 25038-59-9 | 68.97 | 105.00 |
| Liner 2 | PET | 25038-59-9 | 22.66 | 34.50 |
| Total | | 100.00 | 100.00 | 152.25 |

No hazardous components

3. Hazards Identification

N/A

4. First Aid Measures

N/A

5. Fire Fighting Measures

Fire Extinguishing Media: Foam, dry chemical, or water.

6. Accidental Release Measures

N/A

7. Handling and Storage

Store at room temperature

8. Exposure Controls/Personal Protection

Under normal conditions, no special protection is required.
If skin irritation occurs as a result of handling, wash affected areas with soap and water and wear protective clothing to avoid future irritation.

9. Physical and Chemical Properties

Physical State: Solid

10. Stability and Reactivity

Stability: Stable.

11. Toxicological Information

N/A

12. Ecological Information

N/A

13. Disposal Considerations

Normal solid waste disposal methods are recommended.

14. Transport Information

No special handling required.

15. Regulatory Information

N/A

16. Other Information

No other information is available.



Test Report No. F690101/LF-CTSAYAA13-46401

Issued Date: 2013. 10. 11 Page 1 of 6

To: **HANKOOK THREEBOND CO., LTD.**
2Ba, 1007-1 Sihwa Industries
Jungwang-dong
Siheung-si
Gyeonggi-do
Korea

The following merchandise was submitted and identified by the client as :

SGS File No. : AYAA13-46401
Product Name : TB2206S(B13F01)
Item No./Part No. : N/A
Received Date : 2013. 10. 07
Test Period : 2013. 10. 08 to 2013. 10. 11
Buyer(s) : LG, SAMSUNG
Test Results : For further details, please refer to following page(s)
Test Performed : SGS Korea tested the sample(s) selected by applicant with following results.

SGS Korea Co., Ltd.

Jeff Jang / Chemical Lab Mgr

Timothy Jeon
Jinhee Kim
Cindy Park
Jerry Jung/ Testing Person

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Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

SGS Korea Co.,Ltd.

322, The O valley, 555-9, Hoge-dong, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 431-080
t +82 (0)31 4608 000 f +82 (0)31 4608 059 <http://www.sgslab.co.kr> www.kr.sgs.com/greenlab

F052 Version5

Member of the SGS Group (Société Générale de Surveillance)

**Test Report No. F690101/LF-CTSAYAA13-46401**

Issued Date: 2013. 10. 11 Page 2 of 6

Sample No. : AYAA13-46401.001
Sample Description : TB2206S(B13F01)
Item No./Part No. : N/A
Materials : N/A

Heavy Metals

| Test Items | Unit | Test Method | MDL | Results |
|-----------------------------|-------|---|-----|---------|
| Cadmium (Cd) | mg/kg | With reference to IEC 62321:2008, ICP | 0.5 | N.D. |
| Lead (Pb) | mg/kg | With reference to IEC 62321:2008, ICP | 5 | N.D. |
| Mercury (Hg) | mg/kg | With reference to IEC 62321:2008, ICP | 2 | N.D. |
| Hexavalent Chromium (Cr VI) | mg/kg | With reference to IEC 62321:2008, UV-VIS | 1 | N.D. |
| Phosphorous (P) | mg/kg | With reference to EPA 3052(1996), US EPA 6010B(1996), ICP | 10 | N.D. |
| Sb (Sb2O3)* | mg/kg | With reference to EPA 3052(1996), US EPA 6010B(1996), ICP | 10 | N.D. |

Flame Retardants-PBBs/PBDEs

| Test Items | Unit | Test Method | MDL | Results |
|--------------------------|-------|---|-----|---------|
| Monobromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Dibromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Tribromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Tetrabromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Pentabromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Hexabromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Heptabromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Octabromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Nonabromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Decabromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Monobromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Dibromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Tribromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Tetrabromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Pentabromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Hexabromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Heptabromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Octabromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |

NOTE:

- (1) N.D. = Not detected.(<MDL)
- (2) mg/kg = ppm
- (3) MDL = Method Detection Limit
- (4) - = No regulation
- (5) Negative = Undetectable / Positive = Detectable
- (6) ** = Qualitative analysis (No Unit)
- (7) * = Boiling-water-extraction:
Negative = Absence of CrVI coating
Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm² sample surface area.

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t +82 (0)31 4608 000 f +82 (0)31 4608 059 <http://www.sgs.com> <http://www.kr.sgs.com/greenlab>

Member of the SGS Group (Société Générale de Surveillance)

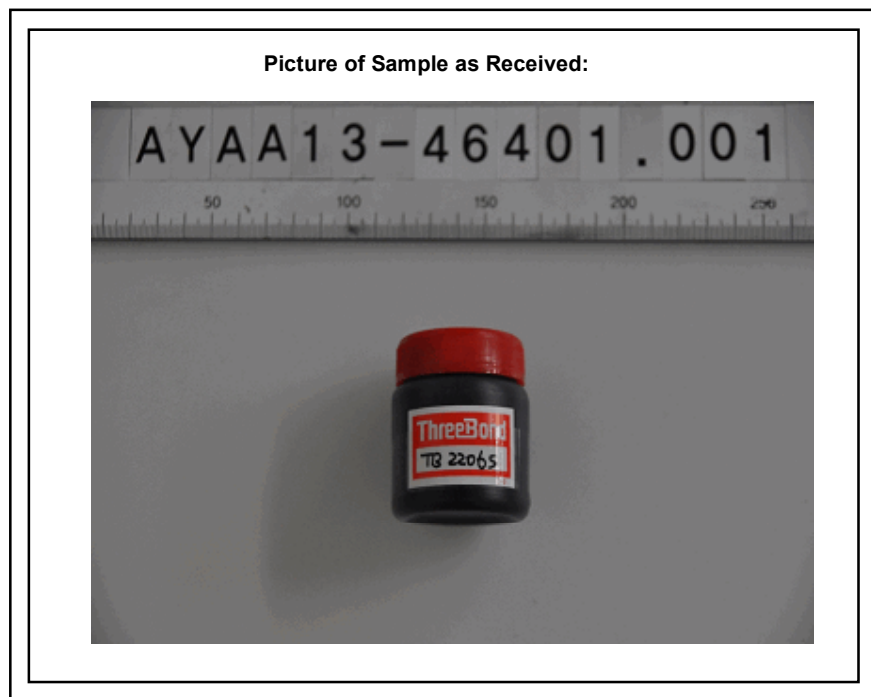
Sample No. : AYAA13-46401.001
Sample Description : TB2206S(B13F01)
Item No./Part No. : N/A
Materials : N/A

Flame Retardants-PBBs/PBDEs

| Test Items | Unit | Test Method | MDL | Results |
|-------------------------|-------|---|-----|---------|
| Nonabromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Decabromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |

Halogen Content

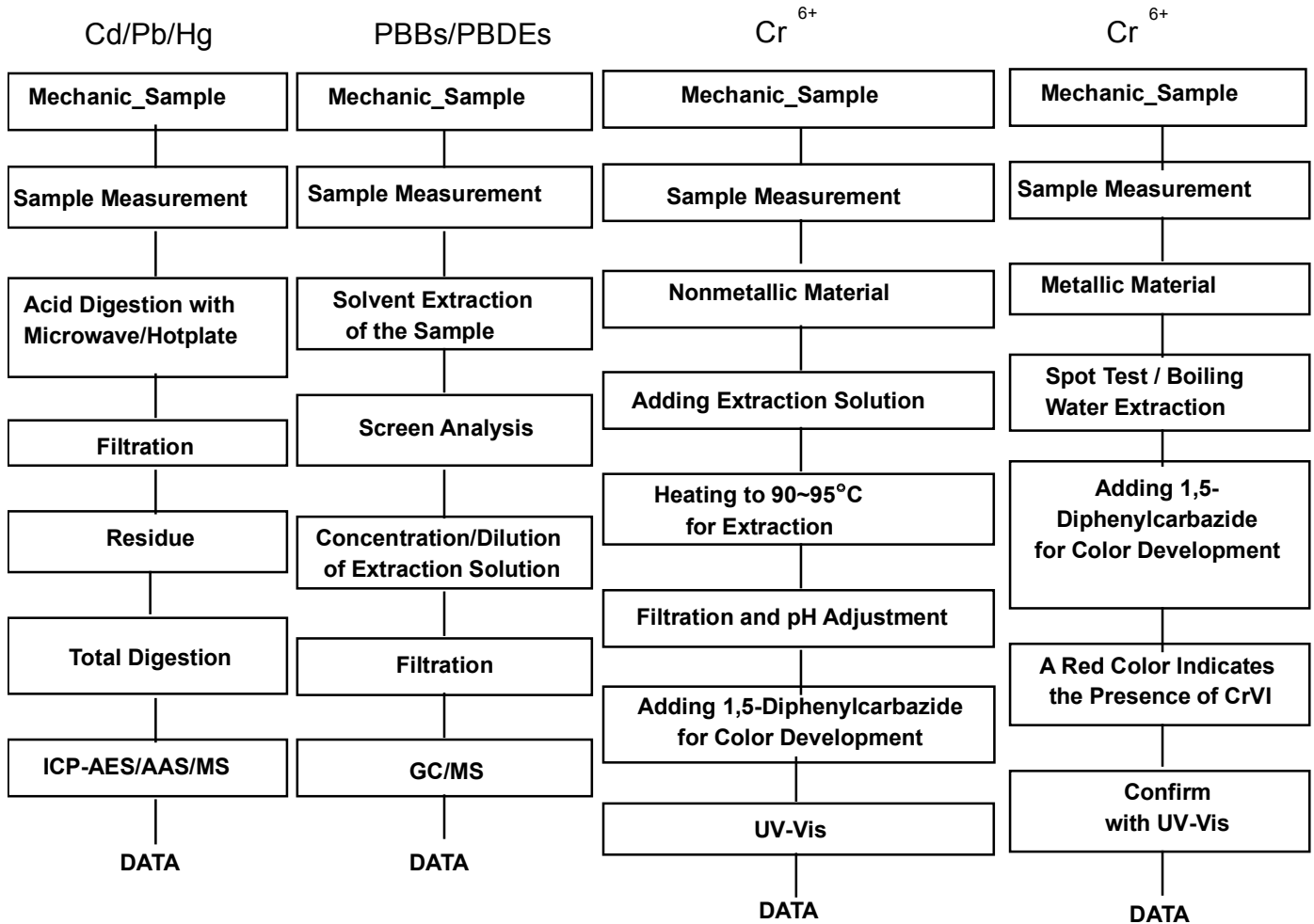
| Test Items | Unit | Test Method | MDL | Results |
|--------------|-------|-----------------------|-----|---------|
| Bromine(Br) | mg/kg | BS EN 14582:2007 , IC | 30 | N.D. |
| Chlorine(Cl) | mg/kg | BS EN 14582:2007 , IC | 30 | 585 |


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 Negative = Absence of CrVI coating
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Testing Flow Chart for RoHS: Cd/Pb/Hg/Cr⁶⁺ /PBBs&PBDEs Testing



The samples were dissolved totally by pre-conditioning method according to above flow chart for Cd,Pb,Hg.
Section Chief : Gilsae Yi

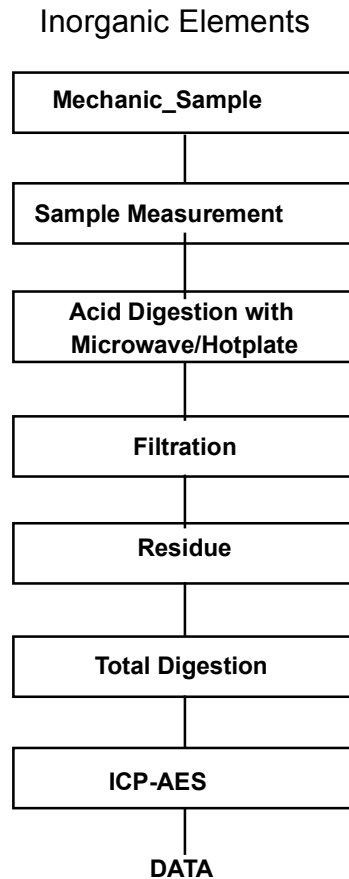
NOTE:

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Flow Chart for Inorganic Elements Testing



| | |
|-------------------------------------|--|
| Major Inorganic Heavy Metals | Antimony(Sb) , Beryllium(Be) , Phosphorus(P) , Arsenic(As) etc. |
|-------------------------------------|--|

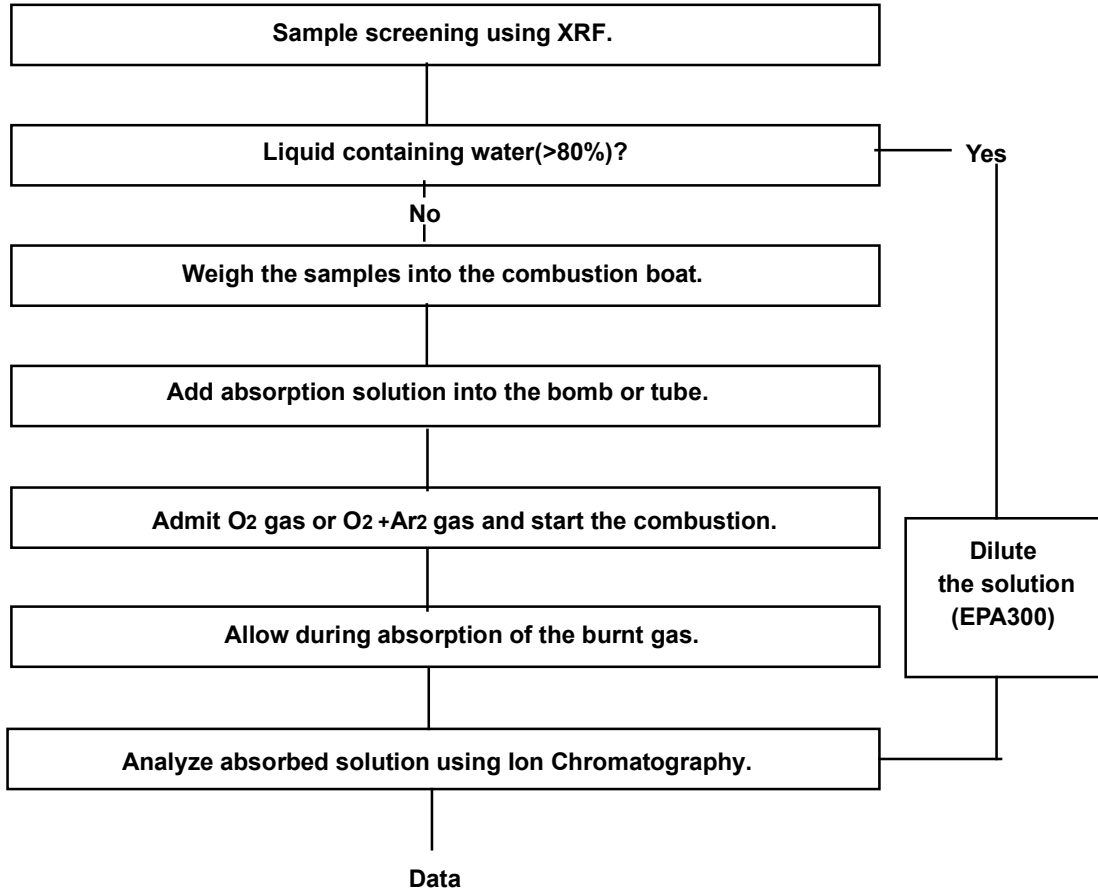
NOTE:

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- (2) mg/kg = ppm
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- (7) * = Boiling-water-extraction:
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Flow Chart for Halogen Test



*** End ***

NOTE:

- (1) N.D. = Not detected.(<MDL)
- (2) mg/kg = ppm
- (3) MDL = Method Detection Limit
- (4) - = No regulation
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Safety Data Sheet

Issued Date: December 09, 2008

Revised Date: February 24, 2010

1. IDENTIFICATION

| | |
|--|--|
| PRODUCT NAME | ThreeBond 2206S |
| ISSUED NUMBER | kenkyukanri 1352-4 |
| NAME OF MANUFACTURER | Three Bond Co.,Ltd |
| ADDRESS | 1456, Hazama-cho, Hachioji-shi, Tokyo, Japan |
| NAME OF SECTION | Administration Department Research Division |
| TEL / FAX NUMBER | 81-42-661-1367/81-42-669-7235 |
| EMERGENCY TEL NUMBER | 81-42-661-1367 |
| RECOMMENDED USE AND RESTRICTION ON USE | Adhesive and sealant |

2. HAZARDS IDENTIFICATION

GHS CLASSIFICATION

| | | |
|-----------------------|--|----------------|
| PHYSICAL HAZARDS | Flammable liquids | Not classified |
| HEALTH HAZARDS | Skin corrosion/irritation | Category 2 |
| | Serious eye damage/Eye irritation | Category 2B |
| | Skin sensitization | Category 1 |
| ENVIRONMENTAL HAZARDS | Acute hazards to the aquatic environment | Category 2 |
| | Chronic hazards to the aquatic environment | Category 2 |

*Not above mentioned hazard classification items; Not classified or Not classifiable.

LABEL ELEMENTS

SYMBOL



SIGNAL WORD

Warning

HAZARD STATEMENT

H315 Causes skin irritation
 H320 Causes eye irritation
 H317 May cause an allergic skin reaction
 H401 Toxic to aquatic life
 H411 Toxic to aquatic life with long lasting effects

NOTICE

SAFETY MEASURE

Wear appropriate chemical protectors; gloves, glasses when handling
 Use personal protection and ventilation equipment to avoid exposure, if necessary.

FIRST-AID MEASURE

If you feel unwell, remove victim to fresh air and keep at rest in a position comfortable for breathing.
 If on skin: Wash with plenty of soap and water. Remove contaminated clothing.
 If skin irritation or rash occurs: Get medical advice, attention.
 If in eyes: Rinse cautiously with water for several minutes.
 Remove contact lenses, if present and easy to do. Continue rinsing. Get medical advice, attention.

STORAGE

Keep container tightly closed. Protect from direct sunlight. Store the product at moderate temperature.

DISPOSAL

Dispose by qualified waste disposal experts.

GHS Hazard Communication is mentioned in accordance with Japanese Law.

Safety Data Sheet

Issued Date: December 09, 2008

Revised Date: February 24, 2010

3. COMPOSITION / INFORMATION ON INGREDIENTS

SUBSTANCE/MIXTURE Mixture

CHEMICAL COMPOSITION

| INGREDIENTS | Wt% | Formula | CAS Number |
|--|---------|--------------------------------|------------|
| Bisphenol A type epoxy resin, liquid | 22 | — | — |
| Bisphenol F type epoxy resin, liquid | 35 — 45 | — | — |
| Other epoxy resin | < 5 | — | — |
| Modified aliphatic polyamine, Other hardener | 10 — 20 | — | — |
| Aluminum oxide | 15 — 25 | Al ₂ O ₃ | 1344-28-1 |
| Carbon black | < 1 | C | 1333-86-4 |

IMPURITIES AND STABILIZING ADDITIVES WHICH ARE THEMSELVES CLASSIFIED AND WHICH CONTRIBUTE TO THE CLASSIFICATION OF THE SUBSTANCE

No information

4. FIRST-AID MEASURES

| | |
|--------------|---|
| IF INHALED | In case of poisoning, remove victim to fresh air, calm down, keep warm then get medical advice, attention. |
| IF ON SKIN | Wash soap and water. Remove contaminated clothing. If skin irritation or rash occurs: get medical advice, attention. |
| IF IN EYES | Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing, then get medical advice, attention. |
| IF SWALLOWED | Rinse mouth. Get medical advice, attention. |

5. FIRE-FIGHTING MEASURES

| | |
|---------------------------------|--|
| EXTINGUISHING MEDIA | Dry powder, alcohol-resistant foam and carbon dioxide extinguisher, dry sand, water spray |
| SPECIFIC HAZARDS | May produce poisonous and irritated gasses upon a fire. |
| SPECIFIC FIRE-FIGHTING MEASURES | Workers should wear appropriate protection (safety glasses, protective clothes, mask for organic poisonous gasses, etc.), then extinguish from up wind position. |

6. ACCIDENTAL RELEASE MEASURES

| | |
|---|---|
| PERSONAL PRECAUTIONS, PROTECTIVE EQUIPMENT AND EMERGENCY PROCEDURES | Wear appropriate protective equipment (refer to 8. Exposure Control/Personal Protection) to avoid contact to eyes, skin and inhalation. |
| ENVIRONMENTAL PRECAUTIONS, RECOVERY/NEUTRALIZATION | Caution not to allow product flow into rivers and not to effect to environment. |
| METHODS AND MATERIALS FOR CONTAINMENT AND CLEANING UP | In case of a small spill, absorb with dry sand, soil, sawdust, cloth, etc., then place in a sealable container. In case of large spills, dike and prevent overflow. Guide to a safe place then dispose properly. |
| SECONDARY ACCIDENT PREVENTION MEASURE | All ignition sources should be quickly removed. (No smoking in vicinity, prohibit sparks or fire sources) |

7. HANDLING AND STORAGE

| | |
|--|---|
| HANDLING | |
| ENGINEERING MEASURES | Wear protective equipment. Perform engineering measures in accordance with 「8. Exposure Control / Personal Protection」. |
| LOCAL VENTILATION /GENERAL VENTILATION | Perform local and general ventilation in accordance with 「8. Exposure Control/Personal Protection」. |

Safety Data Sheet

Issued Date: December 09, 2008

Revised Date: February 24, 2010

SAFETY HANDLING PRECAUTIONS

Take precautions against fire

STORAGE

ENGINEERING MEASURES

Keep container tightly closed. Protect from direct sunlight. Store the product moderate temperature.

Refer to the technical data, specifications, and a product label about handling range of temperature.

CONTAINER AND PACKAGING MATERIALS

Keep only in original container. Do not transfer the product to another bottle.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

CONTROL PARAMETERS

| | ACGIH TLV | OSHA PEL |
|--------------------------------------|-----------------------|-----------------------------------|
| Bisphenol A type epoxy resin, liquid | Not established | Not established |
| Bisphenol F type epoxy resin, liquid | Not established | Not established |
| Aluminum oxide | 10 mg/m ³ | 10 mg/m ³ (total dust) |
| Carbon black | 3.5 mg/m ³ | 3.5 mg/m ³ |

ENGINEERING MEASURES

If handling this product indoors, seal off sources or use a local mechanical ventilation system, etc.

Place a safety shower, hand washing sink and an eye wash shower near work area with clearly markings.

PERSONAL PROTECTION EQUIPMENT

RESPIRATORY PROTECTION

Wear mask to prevent organic gas poisoning, if necessary.

HAND PROTECTION

Wear appropriate protective gloves (Polyethylene, rubber, etc., solvent impervious materials).

EYE PROTECTION

Use eye protection. (preferably goggles)

SKIN AND BODY PROTECTION

Wear personal protection apron, boots, if necessary. Do not work with short sleeve shirts.

SANITARY MEASURES

Wash hands thoroughly after handling. Do not eat, drink or smoke when using this product.

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE

| | |
|----------------------------|---------------------------|
| APPEARANCE | Liquid |
| COLOUR | Black — Japanese |
| FLASHPOINT | None flammable |
| SPECIFIC GRAVITY (DENSITY) | 1.34 |
| SOLUBILITY | Slightly soluble in water |
| VISCOSITY | 15 Pa·s |

PHYSICAL STATE as Aluminum oxide

| | |
|------------------------------|------------------------------|
| MELTING POINT/FREEZING POINT | 1999 °C – 2032 °C(α-Alumina) |
| SOLUBILITY | Insoluble in water |

10. STABILITY AND REACTIVITY

STABILITY

Reacts upon high temperature.

POSSIBLY HAZARDOUS REACTION

Suddenly reacts with strong oxidizers, strong inorganic bases.

When hardening in large quantity, product may generate a great deal of heat.

During sudden hardening a harmful gas is produced; may cause carbonization or decomposition.

CONDITION TO AVOID

High temperature during storage.

INCOMPATIBLE MATERIALS

Oxidizer, Inorganic bases.

HAZARDOUS DECOMPOSITION

Incineration may produce poisonous gasses (Carbon monoxide, Ammonia,

Safety Data Sheet

Issued Date: December 09, 2008

Revised Date: February 24, 2010

NOx, Low molecule organic compounds, etc.) upon condition.

11. TOXICOLOGICAL INFORMATION

HEALTH HAZARDS

ACUTE TOXICITY No data as product

SKIN CORROSION/IRRITATION No data as product

Information on GHS Hazard Communication is in accordance with Japanese Law

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL HAZARDS

HAZARDS TO THE AQUATIC ENVIRONMENT No data as product

MOBILITY No data

Information on GHS Hazard Communication is in accordance with Japanese Law

13. DISPOSAL CONSIDERATIONS

METHOD OF DISPOSAL

To dispose product, solicit waste disposal management experts.

Do not discharge waste nor cleaning agents containing this product into rivers, etc. And do not bury or landfill as is.

Handle in used container and cloth same as above.

14. TRANSPORT INFORMATION

INTERNATIONAL REGULATION

SEA TRANSPORTATION In accordance with IMO regulations

UN number 3082

Proper shipping name Environmentally hazardous substance, liquid, n. o. s.

UN Classification 9

UN packing group III

Marine pollutant P

AIR TRANSPORTATION In accordance with ICAO/IATA regulations

UN number 3082

Proper shipping name Environmentally hazardous substance, liquid, n. o. s.

UN Classification 9

UN packing group III

DOMESTIC REGULATION

SEA TRANSPORTATION In accordance with Japanese Law

UN number 3082

Proper shipping name Environmentally hazardous substance, liquid, n. o. s.

UN Classification 9

UN packing group III

Marine pollutant P

AIR TRANSPORTATION In accordance with Japanese Law

UN number 3082

Proper shipping name Environmentally hazardous substance, liquid, n. o. s.

UN Classification 9

UN packing group III

EMERGENCY ACCIDENTAL MEASURE

Yellow card number 171

15. REGULATORY INFORMATION

Handle in accordance with applicable laws and regulations.

16. OTHER INFORMATION

Portions of the above evaluation of dangerous and harmful effects may be insufficient, please perform adequate investigation.

The content in this report is based on information which was available as of the Effective date.

Safety Data Sheet

Issued Date: December 09, 2008

Revised Date: February 24, 2010

But Three Bond Co.,Ltd. and its affiliates are not responsible for guaranteeing the above data and evaluations.

The above data assumes usage under normal working conditions.

In case of special handling is required, please handle with suitable safety measures according to the application and usage.

The content in this report may change due to new evaluation and tests, etc.

In case there are differences in the translation, the Japanese language version takes precedence.



Test Report No. F690101/LF-CTSAYAA14-13143

Issued Date : 2014. 03. 11

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ROF CO.,LTD
#448-193 Hakwoon-ri, Yangchon-myun
Gimpo-si, Gyeonggi-do
Korea

The following sample(s) was/were submitted and identified by/on behalf of the client as:-

SGS File No. : AYAA14-13143
Product Name : Silver Plated Stainless Steel 301 Strips
Item No./Part No. : F.Agx1_STS301 (F.Agx1_STS301)
Received Date : 2014. 03. 06
Test Period : 2014. 03. 07 to 2014. 03. 11
Test Results : For further details, please refer to following page(s)

SGS Korea Co., Ltd.

Jeff Jang / Chemical Lab Mgr

The results shown in this test report refer only to the sample(s) submitted by the client, not cover the quality of the whole batch. This report should be used as intended, and shall not be used for advertisement and lawsuit.

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Sample No. : AYAA14-13143.001
Sample Description : Silver Plated Stainless Steel 301 Strips
Item No./Part No. : F.Agx1_STS301 (F.Agx1_STS301)
Materials : N/A

Heavy Metals

| Test Items | Unit | Test Method | MDL | Results |
|--|-------|---------------------------------------|-----|----------|
| Cadmium (Cd) | mg/kg | With reference to IEC 62321:2013, ICP | 0.5 | N.D. |
| Lead (Pb) | mg/kg | With reference to IEC 62321:2013, ICP | 5 | N.D. |
| Mercury (Hg) | mg/kg | With reference to IEC 62321:2013, ICP | 2 | N.D. |
| Hexavalent Chromium (Cr VI) By boiling water extraction* | ** | With reference to IEC 62321:2008 | - | Negative |

Flame Retardants-PBBs/PBDEs

| Test Items | Unit | Test Method | MDL | Results |
|--------------------------|-------|---|-----|---------|
| Monobromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Dibromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Tribromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Tetrabromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Pentabromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Hexabromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Heptabromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Octabromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Nonabromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Decabromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Monobromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Dibromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Tribromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Tetrabromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Pentabromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Hexabromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Heptabromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Octabromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Nonabromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Decabromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |

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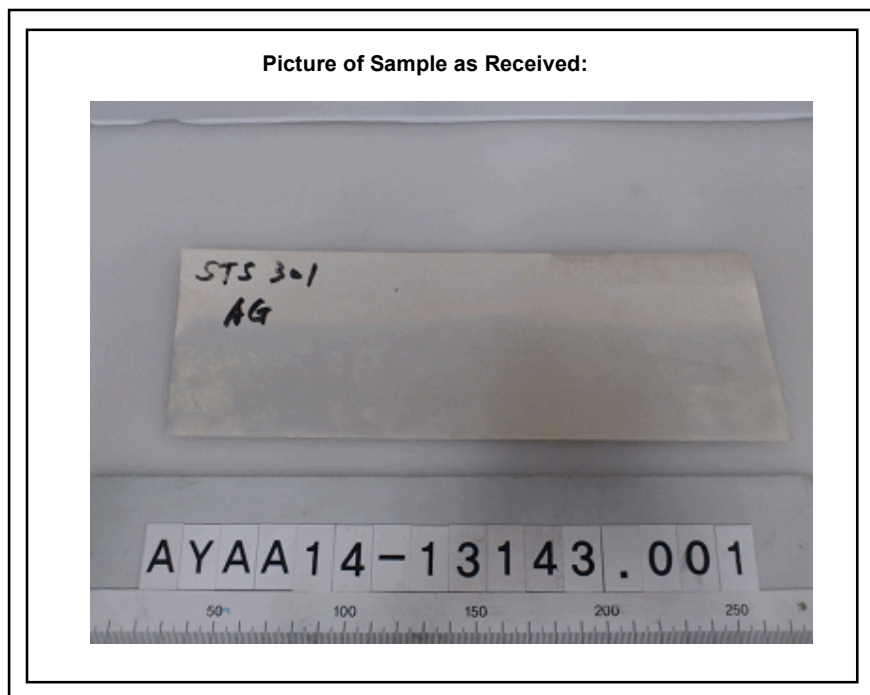


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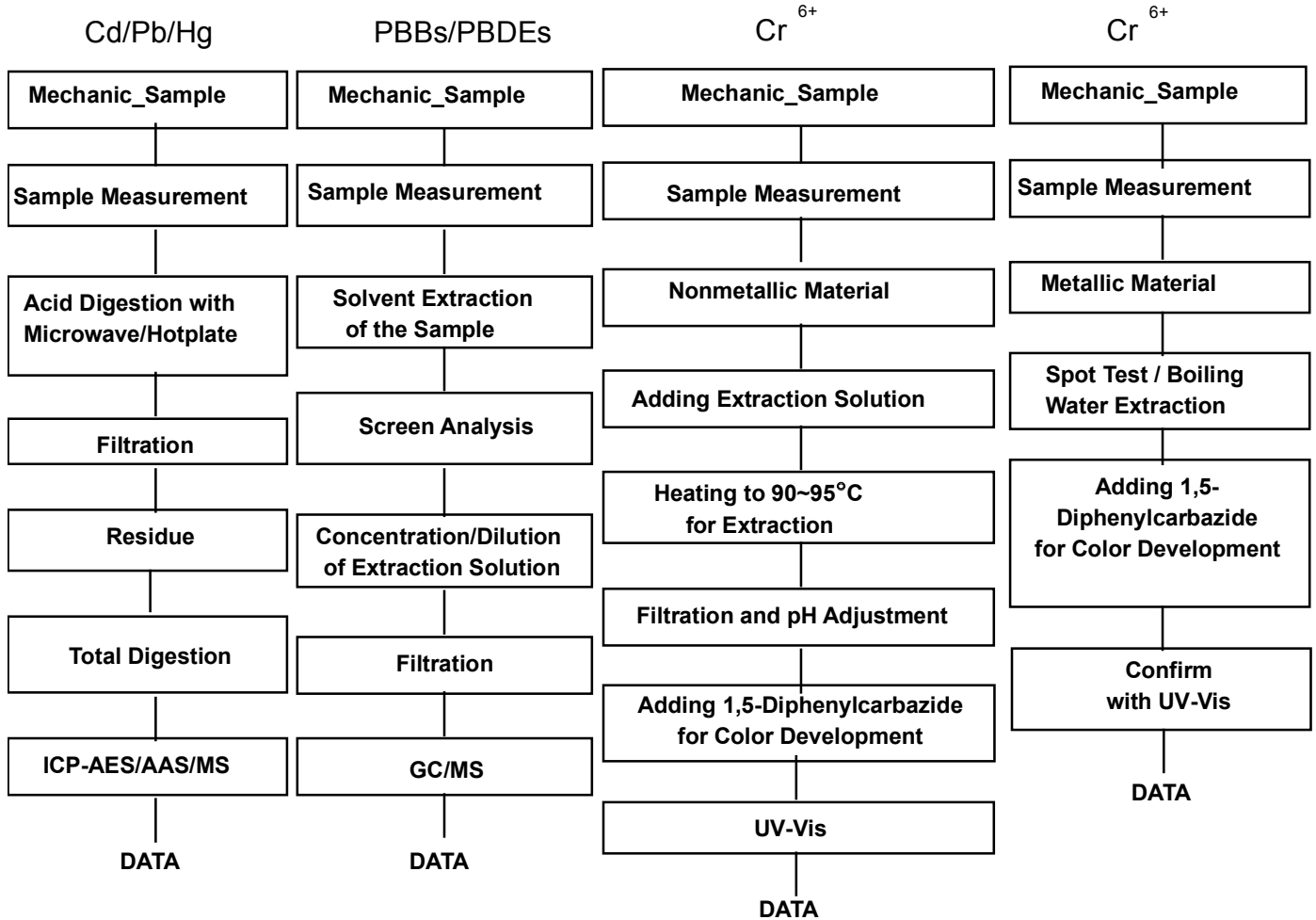
- NOTE:
- (1) N.D. = Not detected.(<MDL)
 - (2) mg/kg = ppm
 - (3) MDL = Method Detection Limit
 - (4) - = No regulation
 - (5) Negative = Undetectable / Positive = Detectable
 - (6) ** = Qualitative analysis (No Unit)
 - (7) * = Boiling-water-extraction:
 - Negative = Absence of CrVI coating
 - Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm² sample surface area.



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Testing Flow Chart for RoHS:Cd/Pb/Hg/Cr⁶⁺ /PBBs/PBDEs Testing



The samples were dissolved totally by pre-conditioning method according to above flow chart for Cd,Pb,Hg.
Section Chief : Gilsae Yi

*** End of Report ***

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물질안전보건자료(MSDS)

[이 자료는 산업안전보건법 제41조 규정에 의거 작성된 것임]

물질명 : 300계열 스테인레스강 (300 series Stainless Steel) : 코일, 시트 등

1. 화학제품과 회사에 관한 정보

- 물질명: 300계열 스테인레스강(냉연.소둔코일, 시트 등)
- 동의어/상품명: 스테인레스강
- 제품의 용도: 스테인레스
- 제조사: 우편번호 790-360, 경북 포항시 남구 동촌동 5번지, 포스코
- 작성부서 및 이름: 노무안전부 보건지원팀 이영세, 채종홍(054-220-7021,7046)
- 작성일자: 2000. 10. 11
- 개정횟수 및 최종 개정일자: 2회, 2003.10.1

2. 구성성분의 명칭 및 함유량

| 성분 | CAS 번호 | 함량 | OSHA PEL | ACGIH TLV | 산업안전보건법 |
|-----|-----------|---------------|---|---|---|
| 철 | 7439-89-6 | balance | 10 mg/m ³ - 산화철 흡 | 5 mg/m ³ -산화철 분진 및 흡 | 5 mg/m ³ |
| 탄소 | 7440-44-0 | 0.035 ~ 0.06% | 15 mg/m ³ -총분진 5 mg/m ³ - 호흡성 분진 | 10 mg/m ³ - 총분진 3 mg/m ³ - 호흡성 분진 | 미규정 |
| 실리콘 | 7440-21-3 | 0.4~0.6% | 15 mg/m ³ 총분진 5 mg/m ³ - 호흡성 분진 | 10 mg/m ³ | 10 mg/m ³ |
| 망간 | 7439-96-5 | 1.0~1.3% | 5 mg/m ³ (C) - 흡과 망간 성분 | 0.2 mg/m ³ | 5 mg/m ³ (분진) 1 mg/m ³ (흡) |
| 인 | 7723-14-0 | 0~0.035% | 0.1 mg/ m ³ | 0.01mg/ m ³ | 0.1 mg/ m ³ |
| 황 | 7704-34-9 | 0~0.01% | 15 mg/m ³ - 총분진 5 mg/m ³ 호흡성 분진 | 10 mg/m ³ - 총분진 3 mg/m ³ - 호흡성 분진 | 미규정 |
| 니켈 | 7440-02-0 | 8.1~8.5% | 1 mg/m ³ - as Ni | 1.5 mg/m ³ - as Ni 0.2 mg/m ³ - 불용해성 | TWA : 0.5mg/m ³ |
| 크롬 | 7440-47-3 | 18.1~18.7% | 1 mg/m ³ - 크롬 메탈 | 0.5 mg/m ³ - 크롬메탈 또는 Cr III compounds | 0.5 mg/m ³ |
| 구리 | 7440-50-8 | 0~0.5% | 0.1 mg/m ³ - 구리 흡 1 mg/m ³ - 분진, 미스트 | 0.2 mg/ m ³ - 흡 1 mg/ m ³ - 분진, 미스트 | TWA : 0.1mg/m ³ |
| 티타늄 | 7440-32-6 | 0~0.2% | 15 mg/m ³ - 총분진 5 mg/m ³ 호흡성 분진 | 10 mg/m ³ | TWA 0.1mg/m ³ |

*소량의 성분이 포함되어 있을 수도 있음.(몰리브덴 0.01%, 니켈 0.05%, 바나듐 0.05%)

3. 위험 유해성

- NFPA 등급(0-4 단계): 보건=0 화재=0 반응성=0
- 응급상황을 위한 개요:
- 주요 침입경로 및 장기 : 흡입을 통한 기관지계 침투
- 주요한 건강위험성: 화상의 위험성이 있음. 금속 분진과 증기의 흡입은 호흡기계 장애를 유발. 각막에 외부물질이 들어갈 경우 치료하지 않으면 녹이 침착됨.

- 급성 반응
 - 흡입: 단기간 노출: 상기도 자극 현상, 금속열(열, 오한, 상기도 건조, 근육통, 무력감)
 - 눈 접촉: 자극, 시력 불선명, 눈 손상
 - 피부 접촉: 자극, 알레르기 반응, 피부장애, 화상
 - 섭취: 잘 발생하지 않음, 만약 섭취한다면 불수용성이므로 오심과 구토가 발생할 수 있음.
- 잠재적 건강영향:
 - 흡입:
 - 철(IRON): 철분 진폐증 발생(X-선 진단, 기능 변화 없음)
 - 탄소(CARBON): 폐기능 장애
 - 실리콘(SILICON): 건강장애 낮음
 - 망간(MANGANESE): 중추신경계 장애, 무기력, 졸음, 감정 불안, 경직보행, 가면양 얼굴, 감염에 대한 감수성 증가
 - 적린(PHOSPHORUS, RED): 기관지 장애
 - 황(SULFUR): 피부, 눈, 폐, 위장관 장애
 - 니켈(NICKEL): 알러지성 피부염, 호흡기 자극, 천식, 폐 섬유화, 안구 자극, 부종, 비강암 또는 폐암 유발 가능성. 금성성 니켈의 경우 암을 유발하지 않으나 용해성 니켈에 만성적으로 노출될 경우 호흡기계 암 유발(1 mg Ni)
 - 크롬(CHROMIUM) : 크롬은 산화 상태에 따라 독성이 다르며 일반적인 형태인 금속형태인 경우는 위험성이 덜함. 6가 크롬의 경우 매우 독성이 강함. 6가 크롬에 반복적인 노출은 호흡기 자극, 비출혈, 비중격의 천공, 암 등이 발생할 수 있음.
 - 구리(COPPER): 구리에 장기적인 노출은 점막자극, 치매 유발, 동물실험에서 적혈구 용혈, 간과 췌장에 헤모푸신 침착, 폐세포의 손상, 위장관계 증상 유발
 - 티타늄(TITANIUM) : 10 mg/m³이하의 분진 흡입에 건강장해 유발 안됨.
 - 피부 접촉: 단기간 노출시 보고된 영향과 같음, 자극, 피부장애
 - 눈 접촉: 장기간 노출: 자극, 눈 손상
 - 섭취: 잘 발생하지 않음
- 발암성:
 - 미국 산업안전보건청(OSHA): 아니오
 - 미국 국립독성계획단(NTP): 네
 - 국제 발암성연구소(IARC): 네 (welding fume : Group 2B)
- 만약 만성질환 또는 호흡기계 질환을 가진 사람이 이런 성분들과 접촉할 시에는 반드시 의사와 상담하길 바람.

4. 응급조치 요령

- 흡입: 부작용이 발생하면, 오염되지 않은 지역으로 이동시킬 것. 호흡이 어렵거나 호흡하지 않을 경우 인공호흡을 할 것. 즉시 의사의 치료를 받을 것. 금속열의 치료는 안정, 통증 및 열을 조절.
- 피부 접촉: 피부 자극이 심하면 의사의 진료를 받게 할 것.
- 눈 접촉: 많은 양의 물을 사용하여 적어도 15분 동안 눈을 세척할 것. 곧바로 의사의 치료를 받도록 할 것.
- 섭취: 발생하지 않음

5. 폭발 화재시 대처방법

- 금속제품들은 화재나 폭발의 가능성이 적음.
- 공기 중에 고농도의 금속 분진이 있을 경우 폭발의 위험성은 있음.

6. 누출사고시 대처방법

- 누출된 물질의 처분을 위해 적당한 용기에 수거할 것.
- 상수도 및 하수도에서 떨어진 곳에 둘 것.
- 기준량 이상의 배출에 대해서는 중앙정부 및 지방자치단체에 배출내용을 통지할 것.
- 분진이 발생하지 않도록 진공흡입 장치를 사용하고 물을 뿌려 청소를 해야 함.

7. 취급 및 저장방법

- 저장: 현행법규 및 규정에 의하여 저장 및 취급할 것. 보관에 관한 사항은 최초 용기의 지시내용을 확인할 것. 혼합금지 물질과 분리할 것.
- 취급: 분진발생을 최소화할 수 있는 방법을 사용할 것, 물과 직접적인 접촉을 피할 것.

8. 노출방지 및 개인보호구

- 노출기준: 산업안전보건법 : 2장 참조.
- 공학적 개선
공정 상에서 금속 분진과 흡에 대한 노출을 최소화하는 방안을 강구.
리프트 또는 작업 도구를 적절히 이용.
제조사의 가이드를 참조.
- 환기: 물질이 폭발농도의 위험이 있는 경우에는 해당 환기장치는 방폭설비를 할 것.
국소배기장치 설치할 것. 해당 노출기준에 적합한지 확인할 것.
- 눈 보호: 비산물 또는 유해한 액체로부터 보호되는 보안경을 착용할 것. 작업장 가까운 곳에 분수식 눈 세척시설 및 비상세척설비(샤워식)를 설치할 것.
- 보호의: 적절한 내화학적 보호의를 착용할 것. 고열작업시 방열복 착용.
- 안전장갑: 적당한 내화학적 장갑을 착용할 것. 고열작업시 방열복 착용.
- 보호 물질 유형: 먼, 가죽
- 호흡 보호구: 사용빈도가 높거나 노출이 심한 경우에는 호흡용 보호구가 필요함.

9. 물리화학적 특성

| | | | |
|---------|----------------|------------|--------|
| 물리적 상태 | 고체(액체 >2800°F) | 물 용해도 | 불용성 |
| 색상 및 냄새 | 금속성 회색, 무취 | 끓는점 | 해당 안됨 |
| 증기압 | 해당 안됨 | 증발률 | 해당 안됨 |
| 증기 밀도 | 해당 안됨 | 용융점 | 2750°F |
| 비중(물=1) | 7.4 | 수소이온지수(pH) | 해당 안됨 |

10. 안정성 및 반응성

- 반응성: 상온 상압에서 안정함.
- 피해야 할 조건: 물, 강산, calcium hypochlorite.

11. 독성에 관한 정보

- 발암성: 산업안전보건법 : 미규정
노출에 의해 위험이 증가될 수 있는 경우: 피부 질환 및 알레르기, 호흡기계 이상
탄소 LD50 : 자료가 없음
철 LD50: 30 g/kg - rat/oral
망간 LD50: 9 g/kg rat/oral

실리콘 LD50: 자료가 없음

- 눈: guinea pig의 각막에 금속 분진을 넣은 후 관찰: 녹이 침착
- 피부: 피부와 접촉하면 자극, 피부염, 감각 등을 유발.
- 흡입: 다양한 호흡기계 장애 유발
- 경구: 유용한 정보가 없음
- 만성 및 발암성은 3장을 참조, 변이성과 기형성은 자료가 없음

12. 환경에 미치는 영향

제품 자체가 환경에 미치는 영향은 미약하나 개개인의 구성 성분은 분진과 더불어 환경 오염을 유발할 수 있음.

13. 폐기시 주의사항

적용 규정에 따라 폐기할 것.

14. 운송에 필요한 정보

미국 교통부 (규정): 분류등급이 부여되어 있지 않음.

15. 법적 규제현황

완제품 상태에서 제품의 독성은 거의 없으나 제품을 가공할 때 각 구성물질에 의한 건강 장애가 가능함. 국내 규정은 본문의 2장, ‘구성성분의 명칭 및 함유량’을 참조 바람.

•미국 규정:

- RCRA(40CFR261) : 재활용 가능하면 규제대상 아님.
- CERCLA(40 CFR 302.4) : 구리 망간
- SARA 311/312 Codes (40CFR370)
- SARA 313(40CFR372.65) : 망간
- OSHA 규정(29 CFR 1910.1000): 규제대상 아님(개별 물질별).

• 미국 주 규정:

펜실바니아

유해물질: 칼슘, 실린콘, 황

환경오염물질 : 알루미늄, 구리, 망간

뉴저지

유해물질: 칼슘, 알루미늄, 구리, 망간, 황, 칼슘(special)

캘리포니아 Prop. 65 : 소량의 발암물질 (비소, 카드뮴, 납, 니켈)

16. 기타 참고사항

- 작 성 : 포스코 노무안전부 보건지원팀(이영세, 채종홍)
- 기술 검토: - 동국대학교 예방의학과 교수 임현술
- 서울대학교 예방의학과 교수 조수현
- 연세대학교 예방의학과 교수 노재훈



Test Report No. F690101/LF-CTSAYAA13-36868

Issued Date: 2013. 08. 07 Page 1 of 8

To: **ACE CHEM.**
2161 Seobu-ro
Jangan-gu
Suwon-si
Gyeonggi-do
Korea

The following merchandise was submitted and identified by the client as :

SGS File No. : AYAA13-36868
Product Name : VECTRA
Item No./Part No. : N/A
Client Reference Data : E130I, E130G, E463I, E471I, E473I, E488I, FIT70 D-3, FIT72, S475, V143LC
Received Date : 2013. 07. 31
Test Period : 2013. 08. 01 to 2013. 08. 07
Buyer(s) : SAMSUNG, LG
Test Results : For further details, please refer to following page(s)
Test Performed : SGS Korea tested the sample(s) selected by applicant with following results.
Report Comments : By the applicant's request, item No.s/part No.s & client reference information are stated/added on report.

Timothy Jeon
Jinhee Kim
Cindy Park
Jerry Jung/ Testing Person

SGS Korea Co., Ltd.

Jeff Jang / Chemical Lab Mgr

**Test Report No. F690101/LF-CTSAYAA13-36868**

Issued Date: 2013. 08. 07 Page 2 of 8

Sample No. : AYAA13-36868.001
Sample Description : VECTRA
Item No./Part No. : N/A
Materials : LCP

Heavy Metals

| Test Items | Unit | Test Method | MDL | Results |
|-----------------------------|-------|---|-----|---------|
| Cadmium (Cd) | mg/kg | With reference to IEC 62321:2008, ICP | 0.5 | N.D. |
| Lead (Pb) | mg/kg | With reference to IEC 62321:2008, ICP | 5 | N.D. |
| Mercury (Hg) | mg/kg | With reference to IEC 62321:2008, ICP | 2 | N.D. |
| Hexavalent Chromium (Cr VI) | mg/kg | With reference to IEC 62321:2008, UV-VIS | 1 | N.D. |
| Antimony (Sb) | mg/kg | With reference to EPA 3052(1996), US EPA 6010B(1996), ICP | 10 | N.D. |

Flame Retardants-PBBs/PBDEs

| Test Items | Unit | Test Method | MDL | Results |
|--------------------------|-------|---|-----|---------|
| Monobromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Dibromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Tribromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Tetrabromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Pentabromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Hexabromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Heptabromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Octabromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Nonabromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Decabromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Monobromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Dibromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Tribromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Tetrabromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Pentabromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Hexabromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Heptabromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Octabromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Nonabromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |

NOTE:

- (1) N.D. = Not detected.(<MDL)
- (2) mg/kg = ppm
- (3) MDL = Method Detection Limit
- (4) - = No regulation
- (5) Negative = Undetectable / Positive = Detectable
- (6) ** = Qualitative analysis (No Unit)
- (7) * = Boiling-water-extraction:
Negative = Absence of CrVI coating
Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm² sample surface area.

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SGS Korea Co.,Ltd.

322, The O valley, 555-9, Hogye-dong, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 431-080
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**Test Report No. F690101/LF-CTSAYAA13-36868**

Issued Date: 2013. 08. 07 Page 3 of 8

Sample No. : AYAA13-36868.001
Sample Description : VECTRA
Item No./Part No. : N/A
Materials : LCP

Flame Retardants-PBBs/PBDEs

| Test Items | Unit | Test Method | MDL | Results |
|-------------------------|-------|---|-----|---------|
| Decabromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |

Phthalates

| Test Items | Unit | Test Method | MDL | Results |
|--|-------|--|-----|---------|
| Di-(2-ethylhexyl) phthalate (DEHP) | mg/kg | With reference to ASTM D3421-75, GC-MS | 50 | N.D. |
| Di-n-octyl phthalate (DNOP) | mg/kg | With reference to ASTM D3421-75, GC-MS | 50 | N.D. |
| Dibutyl phthalate (DBP) | mg/kg | With reference to ASTM D3421-75, GC-MS | 50 | N.D. |
| Butylbenzyl phthalate (BBP) | mg/kg | With reference to ASTM D3421-75, GC-MS | 50 | N.D. |
| Diisononyl phthalate (DINP) | mg/kg | With reference to ASTM D3421-75, GC-MS | 50 | N.D. |
| Diisodecyl phthalate (DIDP) | mg/kg | With reference to ASTM D3421-75, GC-MS | 50 | N.D. |
| Diisobutyl Phthalate (DIBP) | mg/kg | With reference to ASTM D3421-75, GC-MS | 50 | N.D. |
| [di(C7-C11 alkyl)phthalate] linear+branched (DIHP) | mg/kg | With reference to ASTM D3421-75, GC-MS | 50 | N.D. |
| [di(C6-C8 alkyl)phthalate] branched (DHNUP) | mg/kg | With reference to ASTM D3421-75, GC-MS | 50 | N.D. |
| Bis(2-methoxyethyl) phthalate (BMP) | mg/kg | With reference to ASTM D3421-75, GC-MS | 50 | N.D. |

Halogen Contents

| Test Items | Unit | Test Method | MDL | Results |
|--------------|-------|--------------------------------------|-----|---------|
| Bromine(Br) | mg/kg | With reference to ASTM D 7359-08, IC | 30 | N.D. |
| Chlorine(Cl) | mg/kg | With reference to ASTM D 7359-08, IC | 30 | N.D. |

Sulfur

| Test Items | Unit | Test Method | MDL | Results |
|------------|-------|--------------------------------------|-----|---------|
| Sulfur(S) | mg/kg | With reference to ASTM D 7359-08, IC | 30 | 59 |

NOTE:

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Negative = Absence of CrVI coating
Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm² sample surface area.

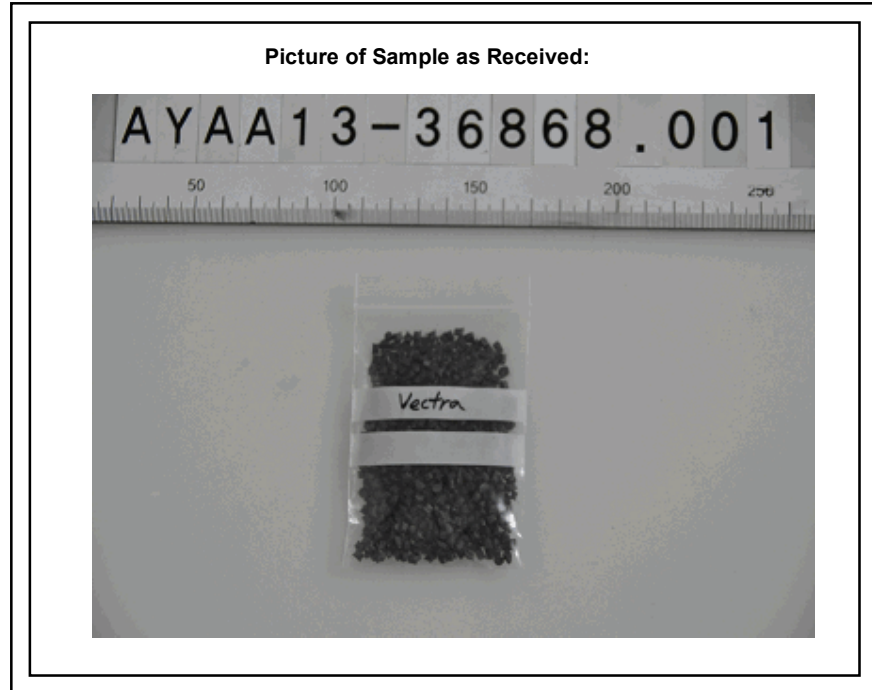
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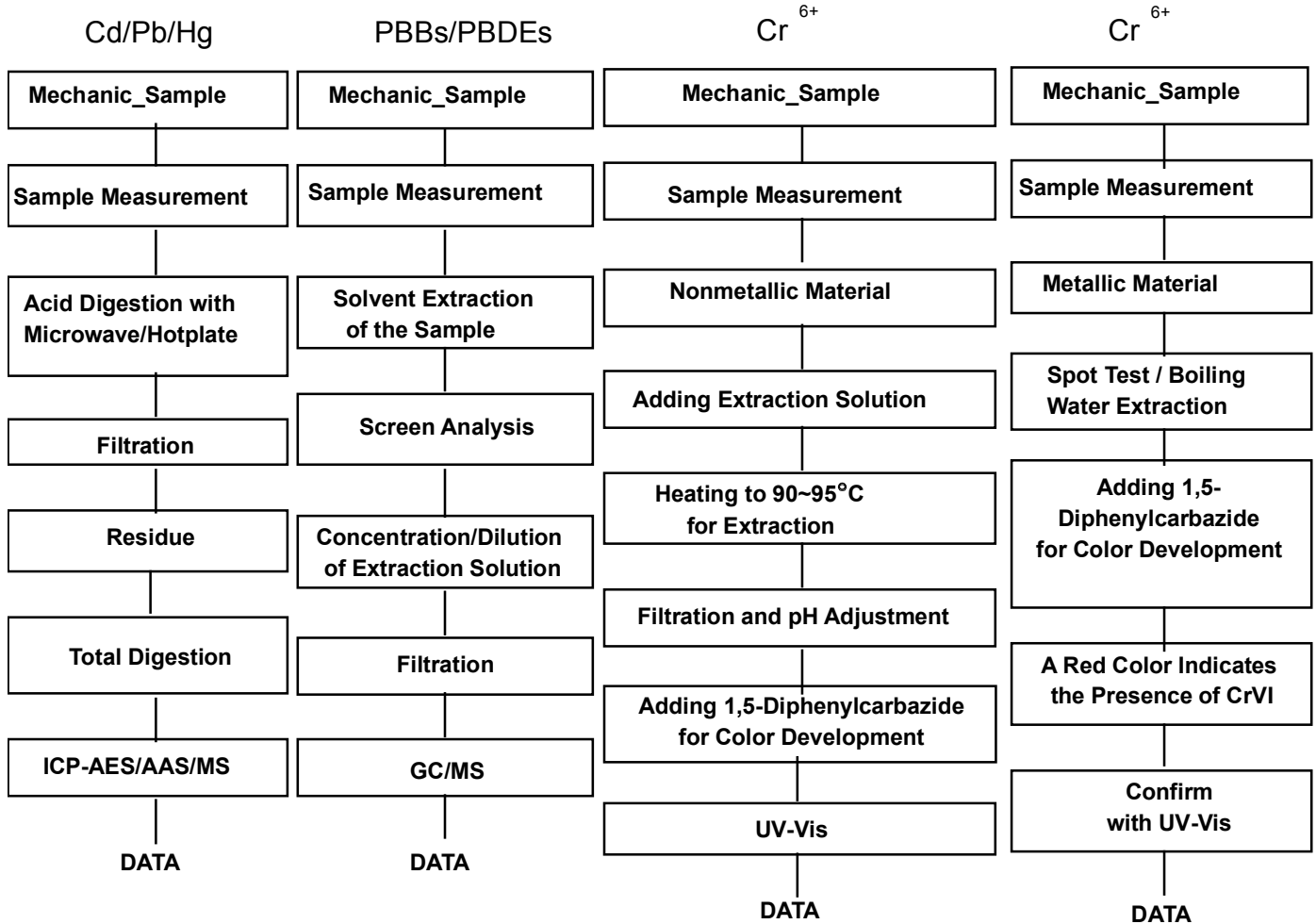
NOTE:

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- (2) mg/kg = ppm
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Testing Flow Chart for RoHS: Cd/Pb/Hg/Cr⁶⁺ /PBBs&PBDEs Testing



The samples were dissolved totally by pre-conditioning method according to above flow chart for Cd,Pb,Hg.
Section Chief : Gilsae Yi

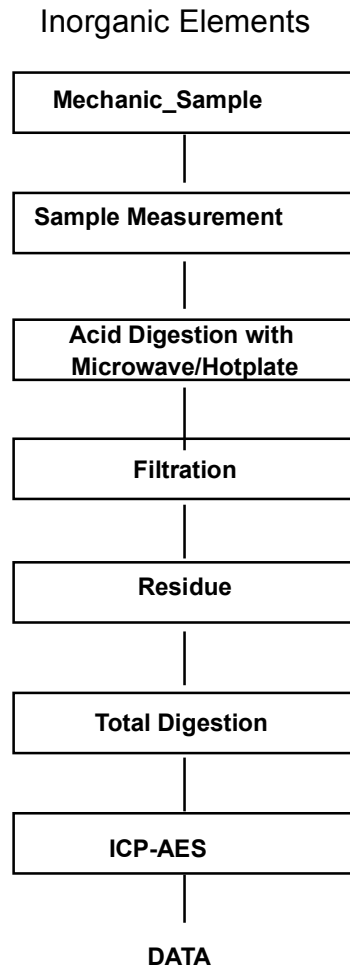
NOTE:

- (1) N.D. = Not detected.(<MDL)
- (2) mg/kg = ppm
- (3) MDL = Method Detection Limit
- (4) - = No regulation
- (5) Negative = Undetectable / Positive = Detectable
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Flow Chart for Inorganic Elements Testing



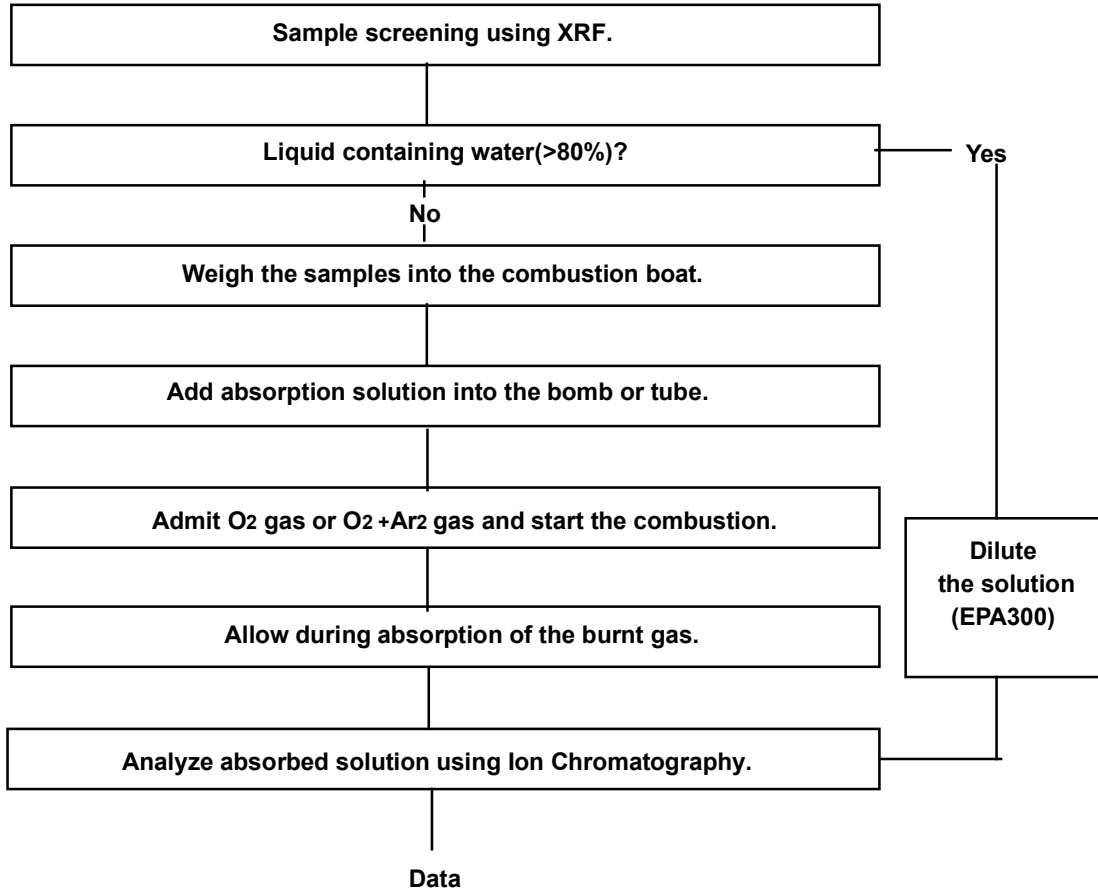
NOTE:

- (1) N.D. = Not detected.(<MDL)
- (2) mg/kg = ppm
- (3) MDL = Method Detection Limit
- (4) - = No regulation
- (5) Negative = Undetectable / Positive = Detectable
- (6) ** = Qualitative analysis (No Unit)
- (7) * = Boiling-water-extraction:
 - Negative = Absence of CrVI coating
 - Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm² sample surface area.

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Flow Chart for Halogen Test



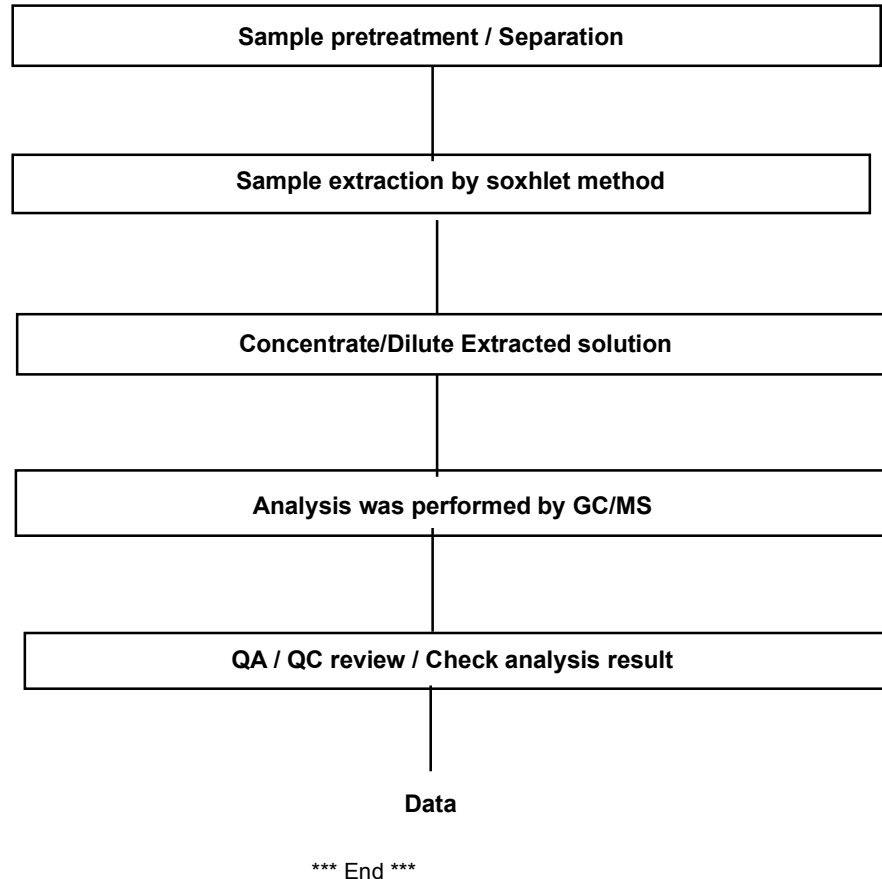
NOTE:

- (1) N.D. = Not detected.(<MDL)
- (2) mg/kg = ppm
- (3) MDL = Method Detection Limit
- (4) - = No regulation
- (5) Negative = Undetectable / Positive = Detectable
- (6) ** = Qualitative analysis (No Unit)
- (7) * = Boiling-water-extraction:
Negative = Absence of CrVI coating
Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm2 sample surface area.

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Flow Chart for Phthalate Test



NOTE:

- (1) N.D. = Not detected.(<MDL)
- (2) mg/kg = ppm
- (3) MDL = Method Detection Limit
- (4) - = No regulation
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- (6) ** = Qualitative analysis (No Unit)
- (7) * = Boiling-water-extraction:
 - Negative = Absence of CrVI coating
 - Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm² sample surface area.

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| | | | |
|------------------------|---------------------------|----------------------|-------------|
| Product name | VECTRA® S475 BK010P BLACK | Revision Date | TNA/EN |
| MSDS number | 8721002716 | Issuing date | Dec.05.2009 |
| Revision Number | 0 | | Aug.23.2011 |

1. Identification of the substance/preparation and of the company/undertaking

Product name VECTRA® S475 BK010P BLACK
Material Number: 21002716
MSDS ID VE1015

Manufacturer, importer, supplier

TICONA
Corporate Headquarters
8040 Dixie Hwy.
Florence, KY 41042
United States
<http://www.ticona.com>

Transportation emergency phone numbers:

In USA, call 800-424-9300
Outside USA, call 703-527-3887, collect calls accepted

Product Emergency

888-522-7816 Ticona - 24 hrs/day, toll free in USA and Canada

Product Information

1-800-833-4882
prodinfo@ticona.com

Synonyms:

Liquid crystal polymer / LCP

End Use:

Plastic processing industry.

2. Hazards identification

Emergency Overview

Dust from this product can form an explosive organic dust cloud.
Spilled pellets may present a slipping hazard.
The molten product can cause serious burns.

Potential health effects

Immediate effects

Inhalation

Dust irritating to respiratory tract. Overheating in processing may generate hazardous, irritating vapours.

| | | | |
|------------------------|---------------------------|----------------------|-------------|
| Product name | VECTRA® S475 BK010P BLACK | Revision Date | TNA/EN |
| MSDS number | 8721002716 | Issuing date | Dec.05.2009 |
| Revision Number | 0 | | Aug.23.2011 |

| | |
|------------------|--|
| Skin | Polymer particles may cause mechanical irritation. The molten product can cause serious burns. |
| Eyes | Resin particles, like other inert materials, are mechanically irritating to eyes |
| Ingestion | Low toxicity by this route is expected based on the biological activity of high molecular weight polymers. |

Medical conditions which may be aggravated by exposure:

No specific information available on the product. Off-gases, which may be released if overheated, may affect those with chronic diseases of the respiratory system.

3. Composition/information on ingredients

Chemical characterization Liquid crystal polymer / LCP, unreinforced

| Components | CAS-No | Percent % |
|--------------|-----------|-----------|
| Carbon black | 1333-86-4 | 1 - 30 |

This product may contain proprietary ingredients. This is a polymeric material. Any hazardous constituents are wetted by the polymer system, and therefore are unlikely to present exposure under normal conditions of processing and handling.

4. First aid measures

Inhalation

Move to fresh air in case of accidental inhalation of vapors. Get medical attention immediately if symptoms occur.

Skin

Cool skin rapidly with cold water after contact with molten polymer. Immediate medical attention is required. Do not peel solidified product off the skin.

Eyes

Immediately flush eye(s) with plenty of water. Call a physician if irritation persists.

Ingestion

If swallowed, do not induce vomiting - seek medical advice.

Notes to physician

This product is essentially inert and nontoxic. However, if it is heated at too high a temperature or if it is burned, gases may be released. Patients who have been exposed to off-gases may need to have their arterial blood gases and carboxyhemoglobin levels checked. If the carboxyhemoglobin levels are normal, asphyxia (carbon dioxide replacing oxygen) is a possibility. As with any fire, irritant gases may have formed. If patients may have inhaled high concentrations of irritating fumes, they should be monitored for delayed onset pulmonary edema.

| | | | |
|------------------------|---------------------------|----------------------|-------------|
| Product name | VECTRA® S475 BK010P BLACK | Revision Date | TNA/EN |
| MSDS number | 8721002716 | Issuing date | Dec.05.2009 |
| Revision Number | 0 | | Aug.23.2011 |

5. Fire-fighting measures

Suitable extinguishing media

Water, Foam, Dry powder

Special exposure hazards arising from the substance or preparation itself, its combustion products, or released gases

carbon monoxide
carbon dioxide (CO₂)
nitrogen oxides (NO_x)

Special protective equipment for fire-fighters

Wear self-contained breathing apparatus and protective suit.

Other Information

Potential dust explosion hazard.

6. Accidental release measures

Personal precautions

Do not breathe dust. Avoid dust formation.

Environmental precautions

No special environmental precautions required.

Methods for cleaning up

Use mechanical handling equipment.

7. Handling and storage

Handling

Protection - fire and explosion:

Do not handle hot or molten material without appropriate protective equipment. Maintain good housekeeping in work areas. Do not exceed recommended process temperatures to minimize release of decomposition products.

Advice on safe handling

Do not smoke in areas where polymer dust is present. Appropriate measures should be taken to control the generation and accumulation of dust during conveying and processing operations.

Storage

Material storage

Store in a cool dry place. Maintain dryness of resin.

8. Exposure controls/personal protection

| | | | |
|------------------------|---------------------------|----------------------|-------------|
| Product name | VECTRA® S475 BK010P BLACK | Revision Date | TNA/EN |
| MSDS number | 8721002716 | Issuing date | Dec.05.2009 |
| Revision Number | 0 | | Aug.23.2011 |

8. Exposure controls/personal protection

OSHA Exposure Limits

| Components | TWA |
|--------------|-----------------------|
| Carbon black | 3.5 mg/m ³ |

ACGIH Exposure Limits

| Components | TWA |
|--------------|-----------------------|
| Carbon black | 3.5 mg/m ³ |

Mexico National Exposure Limits

| Components | LMPE - PPT |
|--------------|-----------------------|
| Carbon black | 3.5 mg/m ³ |

| Components | STEL |
|--------------|---------------------|
| Carbon black | 7 mg/m ³ |

| Components | Mexican Carcinogen Category |
|--------------|-----------------------------|
| Carbon black | A4 |

Exposure controls

Engineering measures

General: May not be adequate as the sole means to control employee exposure.
 Local Exhaust: Recommended when appropriate to control employee exposure to dust or process vapors

Respiratory protection

In case of insufficient ventilation wear suitable respiratory equipment

Skin protection:

When thermal or melt processing, wear long pants, long sleeves, well insulated gloves, and face shield when there is a chance of contact.

Eye/face protection:

Safety goggles. safety glasses with side-shields.

| | | | |
|------------------------|---------------------------|----------------------|-------------|
| Product name | VECTRA® S475 BK010P BLACK | Revision Date | TNA/EN |
| MSDS number | 8721002716 | Issuing date | Dec.05.2009 |
| Revision Number | 0 | | Aug.23.2011 |

Comments:

Operations involving grinding and machining of parts should be reviewed to assure that particulate levels are kept below recommended standards

9. Physical and chemical properties

Appearance

| | |
|-----------------------------|---|
| Form | pellets |
| Odor | slight , specific . |
| Molecular Weight | > 20.000 (base resin) |
| Flash point | > 93°C(200°F) |
| Ignition temperature | > 540°C (1004°F) |
| Method | ASTM D 1929 |
| Density | 1.3 - 1.4 g/ml @ 20°C |
| Bulk density | approx 600-900 kg/m ³ @20 °C |
| Water solubility | insoluble |

10. Stability and reactivity

Reactivity

Stable under normal conditions.

Conditions to avoid

Flame. Avoid prolonged heating at or above the recommended processing temperature.

Incompatible Materials

strong bases.

Hazardous Combustion or Decomposition Products:

Thermal decomposition products may include oxides of nitrogen and carbon.

11. Toxicological information

No data is available on the product itself

12. Ecological information

| | | | |
|------------------------|---------------------------|----------------------|-------------|
| Product name | VECTRA® S475 BK010P BLACK | Revision Date | TNA/EN |
| MSDS number | 8721002716 | Issuing date | Dec.05.2009 |
| Revision Number | 0 | | Aug.23.2011 |

12. Ecological information

Ecotoxicity:

The effects of resin pellets on the wildlife that may ingest them is not well understood. In the case of seabirds, some marine biologists believe that the fowl may not be able to pass plastic pellets through their digestive tracts. Thus, large quantities of ingested pellets may cause intestinal blockage, false feelings of satiation or reduction in absorption of nutrients, causing malnutrition and starvation. The goal of SPI's Operation Clean Sweep is zero loss of pellets into the environment.

Environmental Fate/Information:

This material is considered to be non-biodegradable.

13. Disposal considerations

Disposal considerations

Recycling is encouraged. Dispose of spilled material in accordance with state and local regulations for waste that is non-hazardous by Federal definition. Note that this information applies to the material as manufactured; processing, use, or contamination may make this information inappropriate, inaccurate, or incomplete.

This product as shipped is not a RCRA hazardous waste under present EPA regulations

14. Transport information

US Department of Transportation Not regulated

TDG Not regulated

Mexico Transport Information Not regulated

ICAO/IATA Not restricted

IMDG Not regulated

15. Regulatory information

U.S. FEDERAL REGULATIONS

TSCA Inventory

This product complies with the U.S. Toxic Substances Control Act (TSCA).

SARA 313 Chemicals

Contains no substances at or above the reporting threshold under Section 313.

| | | | |
|------------------------|---------------------------|----------------------|-------------|
| Product name | VECTRA® S475 BK010P BLACK | | TNA/EN |
| MSDS number | 8721002716 | Revision Date | Dec.05.2009 |
| Revision Number | 0 | Issuing date | Aug.23.2011 |

CANADIAN REGULATIONS

WHMIS Classification:

Not a WHMIS controlled product.

WHMIS Ingredient Disclosure List

Carbon Black (1333-86-4)

16. Other information

Prepared By

Product Stewardship Department
Ticona

| | | | |
|-------|-----------|-----------------|--------------------|
| NFPA: | Health: 1 | Flammability: 1 | Instability: 0 |
| HMIS: | Health: 0 | Flammability: 1 | Physical Hazard: 0 |

Changes against the previous version are marked by ***

This product is not intended for use in medical or dental implants.

Refer to the appropriate Ticona bulletins for specific processing guidance and good manufacturing practices (purging, processing parameters, shutdown, etc.).

The information contained herein is accurate to the best of our knowledge. We do not suggest or guarantee that any hazards listed herein are the only ones which exist. Ticona makes no warranty of any kind, express or implied, concerning the safe use of this material in your process or in combination with other substances. Effects can be aggravated by other materials and/or this material may aggravate or add to the effects of other materials. User has the sole responsibility to determine the suitability of the materials for any use and the manner of use contemplated. User must meet all applicable safety and health standards.



Test Report No. F690101/LF-CTSAYAA13-33131

Issued Date: 2013. 07. 15 Page 1 of 5

To: **LEE KU INDUSTRIALS CO., LTD.**
42, Poseunggongdan-ro
Poseung-eup
Pyeongteak-si
Gyeonggi-do
Korea

The following merchandise was submitted and identified by the client as :

SGS File No. : AYAA13-33131
Product Name : C5210(Phosphor Bronze Sn 8%)
Item No./Part No. : N/A
Received Date : 2013. 07. 10
Test Period : 2013. 07. 11 to 2013. 07. 15
Buyer(s) : DIT,SAMSUNG
Test Results : For further details, please refer to following page(s)
Test Performed : SGS Korea tested the sample(s) selected by applicant with following results.

Timothy Jeon
Jinhee Kim
Cindy Park
Jerry Jung/ Testing Person

SGS Korea Co., Ltd.

Jeff Jang / Chemical Lab Mgr

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Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

SGS Korea Co.,Ltd.

322, The O valley, 555-9, Hogye-dong, Dongan-gu, Anyang-si, Gyeonggi-do, Korea 431-080
t +82 (0)31 4608 000 f +82 (0)31 4608 059 <http://www.sgslab.co.kr> www.kr.sgs.com/greenlab

F052 Version5

Member of the SGS Group (Société Générale de Surveillance)

**Test Report No. F690101/LF-CTSAYAA13-33131**

Issued Date: 2013. 07. 15 Page 2 of 5

Sample No. : AYAA13-33131.001
Sample Description : C5210(Phosphor Bronze Sn 8%)
Item No./Part No. : N/A
Materials : N/A

Heavy Metals

| Test Items | Unit | Test Method | MDL | Results |
|--|-------|---------------------------------------|-----|----------|
| Cadmium (Cd) | mg/kg | With reference to IEC 62321:2008, ICP | 0.5 | N.D. |
| Lead (Pb) | mg/kg | With reference to IEC 62321:2008, ICP | 5 | 25.0 |
| Mercury (Hg) | mg/kg | With reference to IEC 62321:2008, ICP | 2 | N.D. |
| Hexavalent Chromium (Cr VI) By boiling water extraction* | ** | With reference to IEC 62321:2008 | - | Negative |

Flame Retardants-PBBs/PBDEs

| Test Items | Unit | Test Method | MDL | Results |
|--------------------------|-------|---|-----|---------|
| Monobromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Dibromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Tribromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Tetrabromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Pentabromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Hexabromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Heptabromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Octabromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Nonabromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Decabromobiphenyl | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Monobromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Dibromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Tribromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Tetrabromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Pentabromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Hexabromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Heptabromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Octabromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Nonabromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |
| Decabromodiphenyl ether | mg/kg | With reference to IEC 62321:2008, GC-MS | 5 | N.D. |

NOTE:

- (1) N.D. = Not detected.(<MDL)
- (2) mg/kg = ppm
- (3) MDL = Method Detection Limit
- (4) - = No regulation
- (5) Negative = Undetectable / Positive = Detectable
- (6) ** = Qualitative analysis (No Unit)
- (7) * = Boiling-water-extraction:
Negative = Absence of CrVI coating
Positive = Presence of CrVI coating; the detected concentration in boiling-water-extraction solution is equal or greater than 0.02 mg/kg with 50 cm² sample surface area.

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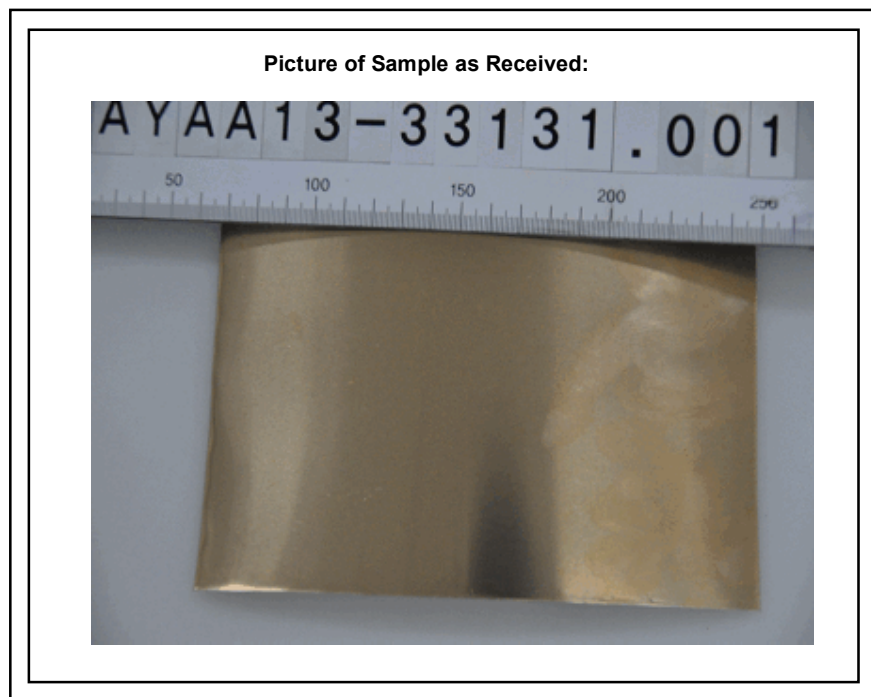
Test Report No. F690101/LF-CTSAYAA13-33131

Issued Date: 2013. 07. 15 Page 3 of 5

Sample No. : AYAA13-33131.001
Sample Description : C5210(Phosphor Bronze Sn 8%)
Item No./Part No. : N/A
Materials : N/A

Halogen Contents

| Test Items | Unit | Test Method | MDL | Results |
|--------------|-------|---------------------------------------|-----|---------|
| Bromine(Br) | mg/kg | With reference to ASTM D 7359-08 , IC | 30 | N.D. |
| Chlorine(Cl) | mg/kg | With reference to ASTM D 7359-08 , IC | 30 | N.D. |



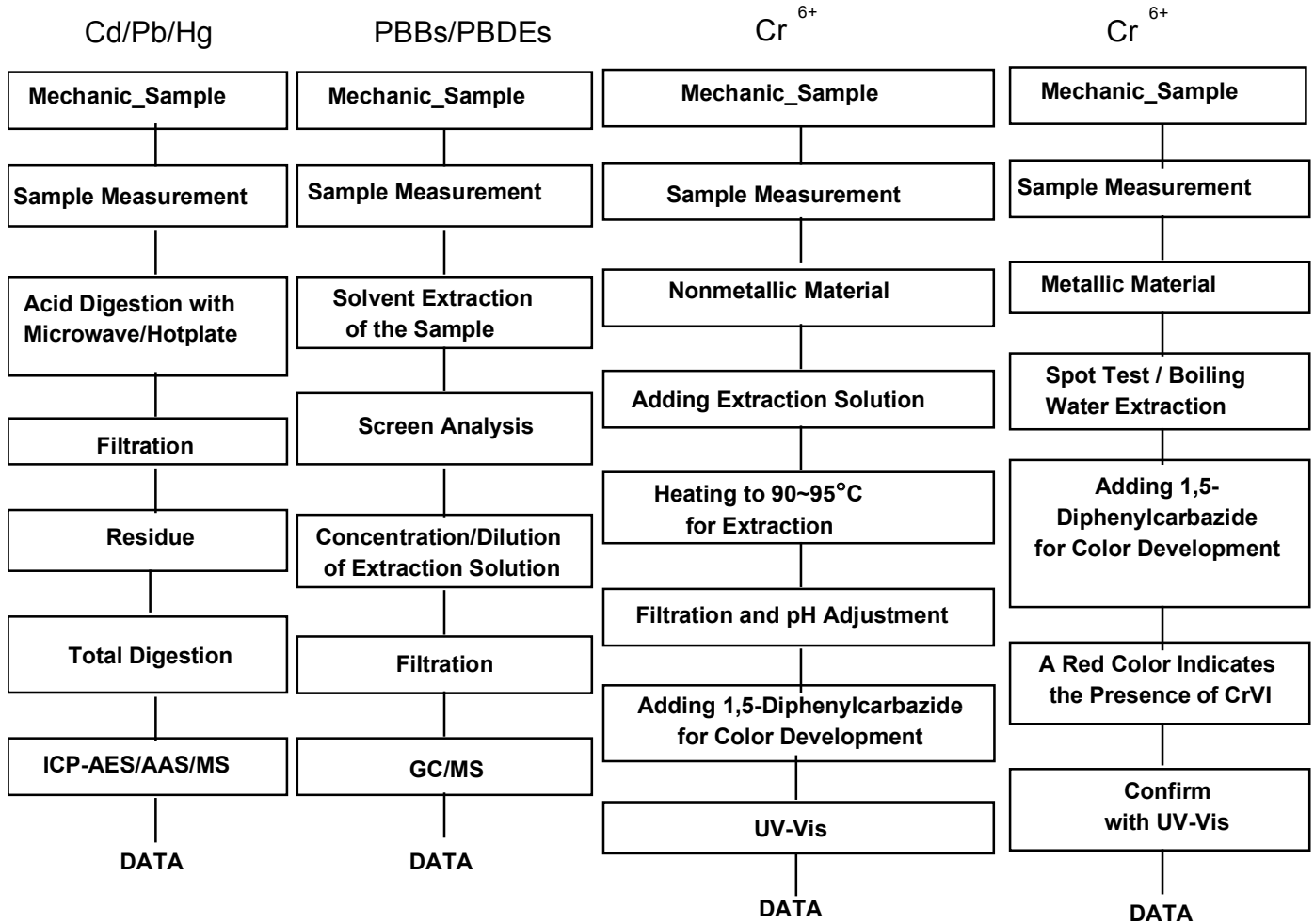
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Testing Flow Chart for RoHS: Cd/Pb/Hg/Cr⁶⁺ /PBBs&PBDEs Testing



The samples were dissolved totally by pre-conditioning method according to above flow chart for Cd,Pb,Hg.
Section Chief : Gilsae Yi

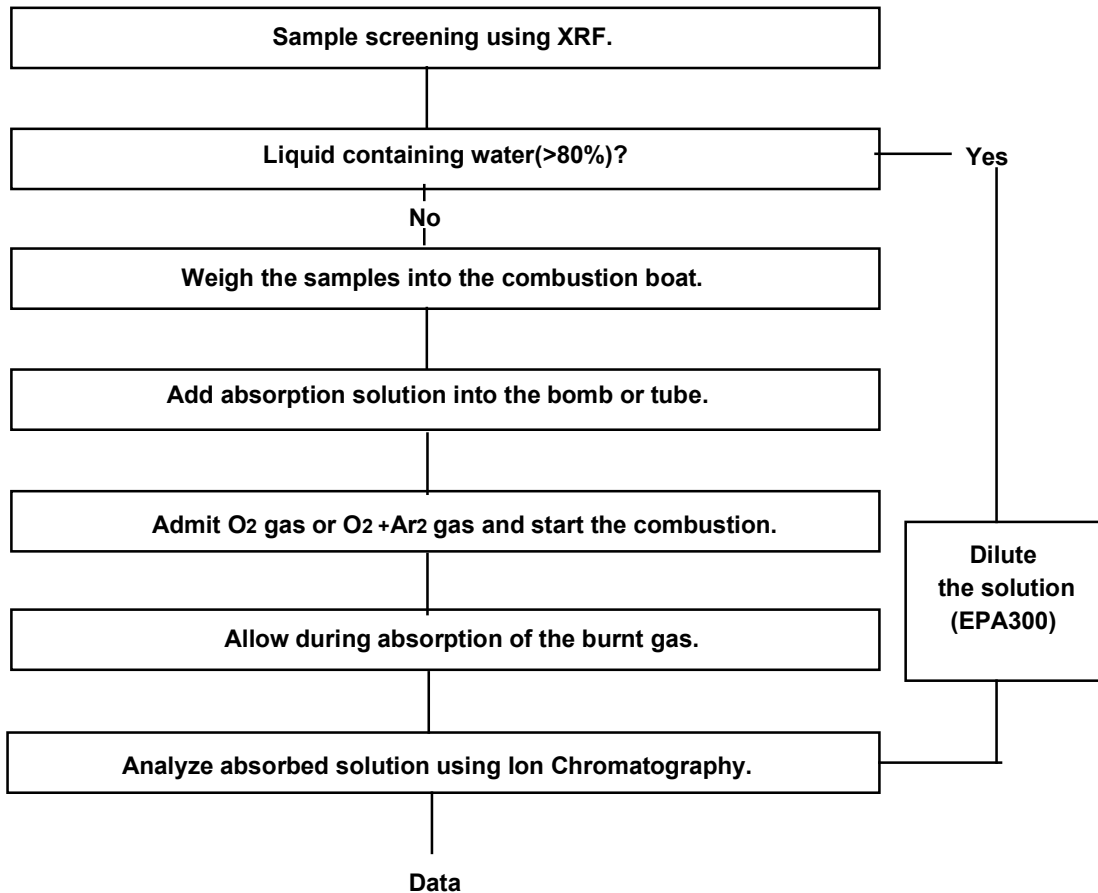
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Flow Chart for Halogen Test



*** End ***

NOTE:

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- (3) MDL = Method Detection Limit
- (4) - = No regulation
- (5) Negative = Undetectable / Positive = Detectable
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물질 안전 보건 자료(MSDS)

(Material Safety Data Sheet)

(이 자료는 산업안전 보건법 제 41조 규정에 의거 작성한 것임)

1. 화학제품과 회사에 대한 정보

① 제품명: 인청동 (PHOSPHOR BRONZE)

② 용도: 전자부품 외

③ 유해성 분류 (노동부 고시기준): 자료없음

④ 화학적 일반 특성 : 고체

⑤ 제조자 주소/정보:

(주)이구산업 반월공장, 주소 - 경기도 안산시 원시동 738번지

전화번호- (031) 494-2929, FAX- (031) 494-2930

(주)이구산업 포승공장, 주소 - 경기도 평택시 포승읍 만호리 616번지

전화번호- (031) 686-7900, FAX- (031) 682-2922

⑥ 공급자 주소/정보: 상동

⑦ 작성부서: 품질관리팀, 제정일자: 2005년 4월 10일, 개정일자 - 2012년 4월 10일

2. 구성성분 명칭 및 조성

| 명칭 | 이명 | CAS-NO | 함유량(%) |
|--------------|----|-----------|------------|
| ① Copper | Cu | 7440-50-8 | 나머지% |
| ② Phosphorus | P | 7723-14-0 | 0.03-0.35% |
| ③ Tin | Sn | 7440-31-5 | 3.5-9.0% |

3. 위험 유해성

① 긴급한 위험, 유해성 정보 :NFPA 등급(0~4단계): 보건 = 2 화재 = 1 반응성 = 0

② 주요한 건강 위험성: 호흡기도 자극, 눈 자극

③ 잠재적 건강영향

흡입 - 단기간 노출 : 자극, 금속 흡 열

장기간 노출 : 금속 맛, 폐 울혈

피부 접촉 - 단기간 노출 : 자극

장기간 노출 : 자극

섭취 - 단기간 노출 : 구역, 구토, 설사, 위통, 체중 감소, 두통

장기간 노출 : 구역, 변비, 위통, 체중 감소

4. 응급조치요령

- ① 흡입 : 부작용이 발생하면 오염되지 않은 지역으로 이동시킬 것, 호흡하지 않을 경우 인공호흡을 실시할 것. 즉시 의사의 치료를 받을 것.
- ② 피부 접촉 : 오염된 의복 및 신발을 제거하는 동안 적어도 15분 동안 비누와 물로 씻을 것. 필요시 의사의 치료를 받도록 할 것. 오염된 의복 및 신발은 재사용 전에 철저히 건조시키고 세탁할 것.
- ③ 눈 접촉 : 많은 양의 물을 사용하여 적어도 15분 동안 눈을 세척할 것. 곧바로 의사의 치료를 받도록 할 것.
- ④ 섭취 : 소방서(응급구조) 또는 의사에게 즉시 연락할 것. 의식 불명의 사람에게 토하게 하거나 음료수를 마시지 않도록 할 것. 구토를 하면 구토물이 막는 것을 방지하기 위하여 머리를 둔부보다 낮추도록 할 것. 만약 사람이 의식 불명이면 머리를 옆으로 돌리게 할 것. 즉시 의사의 치료를 받을 것.

5. 폭발, 화재 시 대처 방법

- ① 인화점/발화점 : 해당없음
- ② 소화제 종류: 입자상 분말 소화약제, 흡, 모래, 일반적인 포말, 물
- ③ 소화방법 및 장비: 타는 물질에 물을 뿌리지 말고 모래등을 사용할 것
- ④ 유해 연소생성물 : 자료없음

6. 누출사고시 대처방법

- ① 직업적 유출 : 열, 화염, 스파크 및 기타 점화원을 피할 것. 누출된 물질을 만지지 말 것
- ② 소량 유출 : 누출된 물질의 처분을 위해 적당한 용기에 수거할 것. 누출지역으로부터 안전한 지역으로 용기를 이동할 것
- ③ 다량 누출 : 물로 아래부분을 적셔줄 것. 추후의 처리를 위한 제방을 축조할 것. 발화원을 제거할 것. 관계인외의 접근을 마고 위험지역을 격리하며 출입을 금지할 것. 기준량 이상의 배출에 대해서는 중앙정부 및 지방자치단체에 배출내용을 통지할 것.

7. 노출 방지 및 개인 보호구

- ① 노출기준 : COPPER(구리) TWA : 0.1mg/m³
TIN(주석) TWA : 2mg/m³
- ② 환기 : 국소배기장치 설치할 것. 물질이 폭발농도의 위험이 있는 경우에는 해당 환기장치는 방폭설비를 할 것. 해당 노출기준에 적합한지 확인할 것.
- ③ 개인 보호구 : 보안경, 보호의, 보호장갑, 방진마스크, 기타
- ④ 위생상의 주의사항 : 제품사용 후 신체청결 및 건조, 오염된 피복은 세탁 후 사용할 것

8. 취급 및 저장 방법

- ① 취급 : 현행법규 및 규정에 의하여 취급할 것. 혼합금지 물질과 분리할 것.
- ② 보관방법 : 수분방지 대책이 된 건조하고 환기가 잘되는 곳에 보관할 것

9. 안전성 및 반응성

- ① 반응성 : 상온 상압에서 안정함.
- ② 혼합금지 물질 : 가연성 물질, 산, 산화제, 금속염, 연기, 할로 탄소 화합물, 할로젠, 과산화물, 환원제, 금속 산화물, 금속
- ③ 위험한 분해생성물 - 열분해 생성물 : 기타 분해생성물
- ④ 중합 반응 : 중합하지 않음

10. 물리 화학적 특성

- | | |
|--------------|---------------|
| ① 외관 : 고체 | ② 냄새 : 무취 |
| ③ PH : 적용안됨 | ④ 용해도 : 적용안됨 |
| ⑤ 비점 :자료없음 | ⑤ 융점 : 1020 ℃ |
| ⑦ 폭발성 : 자료없음 | ⑧ 산화성 : 자료없음 |
| ⑨ 비중 : 8.80 | ⑩ 증기압 : 적용안됨 |

11. 독성에 관한 정보

- ① 급성 경구독성, 경피독성 : 자료없음
- ② 급성 흡입독성 : 자료없음

12. 환경에 미치는 영향

- ① 수생 및 생태 독성 : 자료 없음
- ② 토양 이동성 : 자료 없음
- ③ 잔류성 및 분해성 : 자료없음
- ④ 동생물의 생체 내 축적 가능성 : 자료없음

13. 운송에 필요한 정보

- ① 선박 안전법 위험물선박운송 및 저장규칙에 의한 분류 및 규제 : 위험물에 해당하지 않으며 분류에 대한 자료는 없음
- ② 운송시의 주의사항 : 자료 없음

14. 관련 법규에 관한 정보

- ① 산업안전 보건법 : MSDS 작성대상 물질
- ② 환경 관리법 : 해당없음
- ③ 소방법 : 해당없음

15. 기타 참고사항

- ① 이 MSDS는 산업안전 보건법, 유해화학물질관리법, 소방법, 폐기물 관리법, 고압가스 안전관리법, 농약관리법 및 기타 화학물질관리 관련법을 참고하고 이구산업(주) 보유자료와 당사의 취급경험에 따른 지식에 의거하여 작성
- ② 제품의 사용자는 이 MSDS에서 불충분한 정보에 관하여는 표시된 연락처로 연락을 주시면 가능한 제공하도록 하겠습니다.
- ③ 본 MSDS는 이구산업(주)로부터 해당 제품을 공급받아 제3자에게 제공하는 모든 공급자를 통해 최종사용자에게 까지 전달되어야 하며 공급자가 본 MSDS의 내용의 일부나 전부를 누락 또는 변조한 경우 이구산업(주)는 그 결과에 대해 어떠한 책임도 없음을 밝힘.
- ④ MSDS를 산업안전 보건 목적외 타 경쟁사로의 무단 배포 또는 상업적 목적으로 이용할 수 없음.

상기 사항을 위반하면 저작권에 관련된 국내, 외법에 의거 처벌을 받거나 소송을 제기 당할 수 있습니다.